

YOUR DIGESTIVE SYSTEM

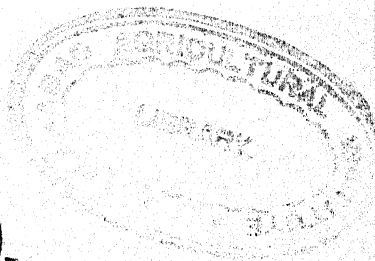


YOUR Digestive System

By LOUIS WINFIELD KOHN, M. D.

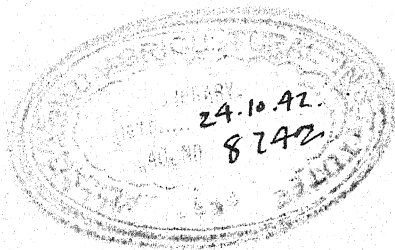


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Preface

SINCE countless millions suffer from digestive disorders at some time or other, an understanding of the functions and diseases of the digestive system is of the utmost importance to everyone. This knowledge is particularly vital when one realizes that every part of the body is dependent upon the digestive processes for maintenance and health.

First, this book describes the various organs involved in the process of digestion; then chapters are devoted to the significance of the individual's medical history, the various methods of examination and analysis, including fluoroscopy and X ray.

Several chapters are devoted to the various digestive disorders and diseases that affect the mouth, esophagus, stomach, intestines, rectum, liver, gall bladder, pancreas, peritoneum, and diaphragm. Included also are the digestive disturbances which result from the presence of other ailments—those due to allergy and those caused by parasites.

The final part of the book offers essential facts about vitamins and diet for proper nutrition and digestion.

The reader, unless he has been a student of the subject, will find that there are more organs comprising the digestive system than he had realized; and he will also find that the structure, function, and diseases of these organs cannot be referred to without the frequent use of medical terms. It should be noted, however, that when the author uses a technical term, he explains its meaning (in parentheses); moreover, he has compiled for the convenience of the reader a Glossary of the technical and medical terms employed throughout the book. To derive the fullest benefit, the reader is urged to consult both the Glossary at the end of the book and the diagrams accompanying the text.

In the writing of this book it was the primary purpose of the author to acquaint the reader more intimately with the various factors involved in the production of digestive disorders, and to help him note the many symptoms which characterize the complaints, so that he may be able properly to judge as to the indications for medical attention.

Diseases of the digestive system, though fundamentally different, are often so much alike in their manifestations that it is rather difficult to determine on the basis of symptoms alone as to which organ is affected. It is also no simple matter to ascertain the true nature of an affliction which affects a concealed organ. For that reason it is often necessary to resort to various methods of examination in order to arrive at a correct diagnosis.

The author has limited his remarks on the treatment of the various diseases to basic principles without going into detail. This he has done intentionally to prevent the readers of this volume from treating themselves or from giving advice in this direction to others. A physician should always be consulted, and no person should be encouraged to treat himself without proper guidance.

The author expresses his sincere thanks to his nephew, Roger Coleman, for the time given and interest shown in the preparation of the drawings and diagrams in this book.

L. W. K.

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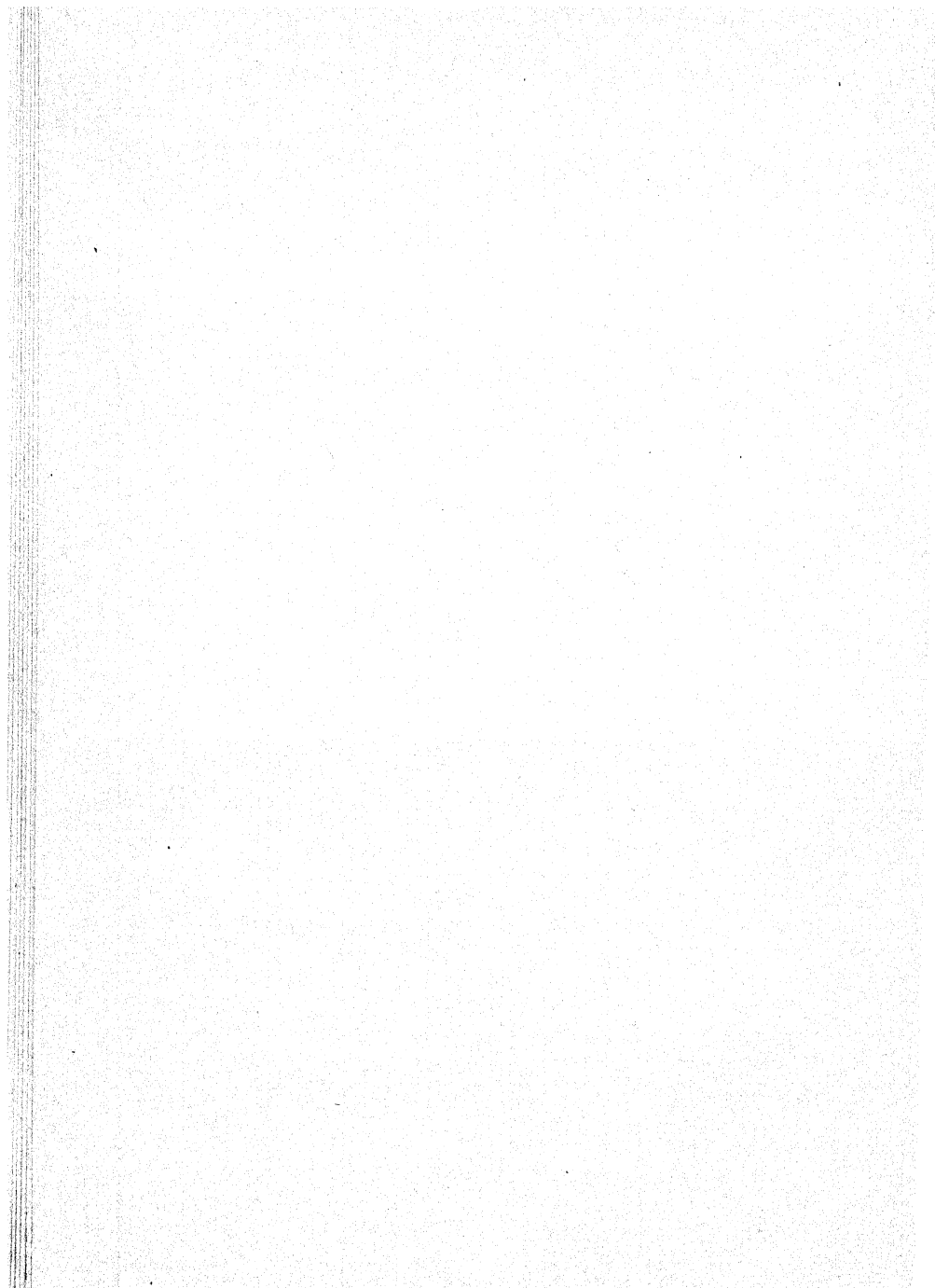
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CHAPTER I

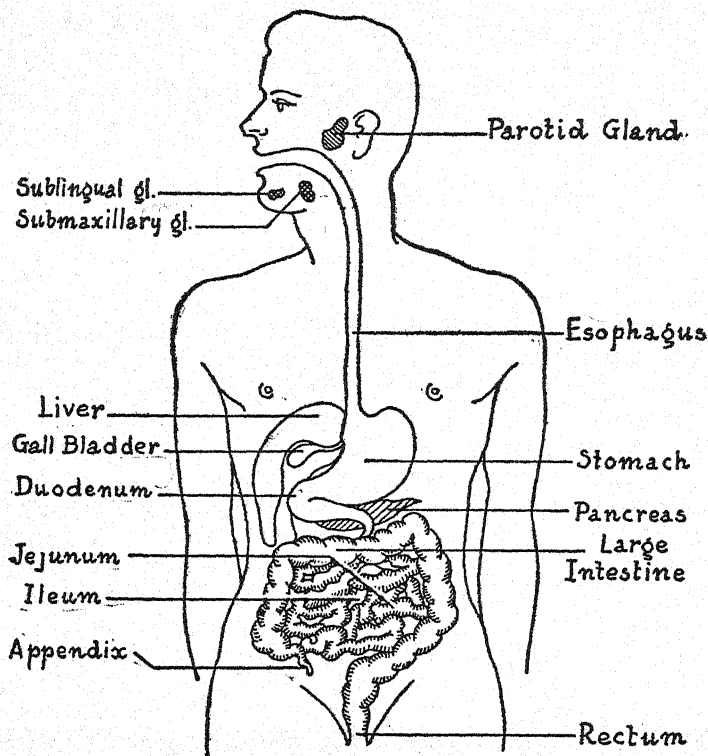
The Organs of the Digestive System and Their Activities

THE ORGANS concerned in the process of digestion begin with the mouth cavity, where the salivary glands contribute their secretions, and continue on with the gullet, stomach, and bowels, ending in the rectum. In addition, the liver, the pancreas, the gall bladder, and the bile ducts are included in the digestive system. Such other organs as the lips, cheeks, tongue, teeth, palate, and throat are also concerned in the earliest steps of digestion. When any of these organs are actually missing, or if they become inefficient because of a retarded function, the deficiency is bound to manifest itself in the form of disease. Incomplete mastication (chewing), for example, is prone to induce disturbances in digestion in other portions of the digestive system.

Digestion is a process which calls into play many types of activity, and affects practically every portion of the digestive tract from inlet to outlet. It is concerned with the preparation and absorption of food as well as with the elimination of certain waste products from the alimentary canal (bowel tract). One of the first in importance among the functions concerned in digestion is the psychic state (mental attitude) of the individual.

Psychic Attitude—To have a normal digestion, it is obviously necessary to have a normal psychic attitude. When this is lacking, at least in so far as a desire for food is concerned, a very poor sense of taste, a disturbed sense of satisfaction, impaired chewing, and improper insalivation of food may all occur. Upon the attitude of mind will depend the nature of the reflex action of the stomach and bowels. One of the most pronounced influences exercised by the mind is its effect upon the stomach and intestinal digestion. This has been aptly demonstrated in animals and is experienced daily in human beings.

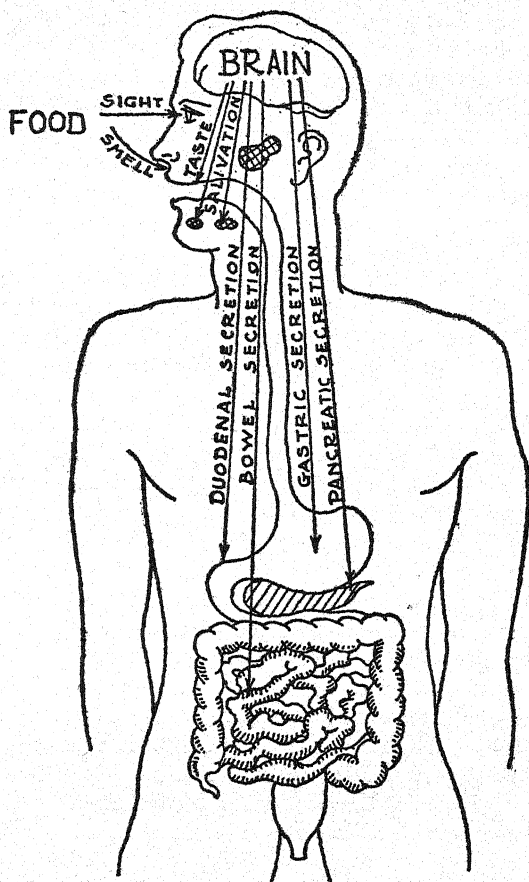
Next in importance, provided a normal attitude of mind exists, is a proper sense of taste and smell. Conversely, a normal functioning of the organs of taste and smell may influence the mind to express itself in a



The above diagram portrays all organs of the digestive system from the mouth downward.

normal manner in regard to its effect upon the organs of digestion. It will, therefore, be readily noted how closely related are the functions of taste and smell with those of the organs of digestion which are influenced by the mind.

Saliva—There are three pairs of salivary glands located in the mouth cavity—a right and left for each side. They are known as the parotid, sub-maxillary, and sub-lingual glands. The *parotid gland* is located inside the mouth—just below the cheek bone in front of the ear. The *sub-maxillary gland* lies in the floor of the mouth under the lower jaw. The *sub-lingual gland* lies in the floor of the mouth under the tongue. From these glands, small ducts lead the secretion into the mouth. With the assistance of the teeth, tongue, cheeks, and palate, the food is



The above diagram shows how, through the sensations of sight, smell, and taste, food influences the brain, which in turn sends out impulses affecting the stomach, the duodenum, the small intestines, and the pancreas.

broken up, molded, and thoroughly admixed with the first of the digestive secretions—the saliva (the product secreted by the above-mentioned glands). About a quart and a half of saliva are secreted daily by these glands. The rate of secretion is influenced by the sight or smell of food, by mental influences, and by other reflex stimuli from other parts of the body as well as from within the mouth itself.

The most important digestive constituent of the saliva is known as *ptyalin* (a starch ferment), which aids in the digestion of the starches. Starch foods are given their first digestive treatment through the medium of this ferment. In addition, saliva is believed to have a powerful antiseptic action, and is presumed by some authorities to destroy particularly certain toxins. One of the most important functions of the saliva, however, is to serve as a solvent of various foodstuffs; this action facilitates the preparation of the food (assembling it into mass form) as well as swallowing.

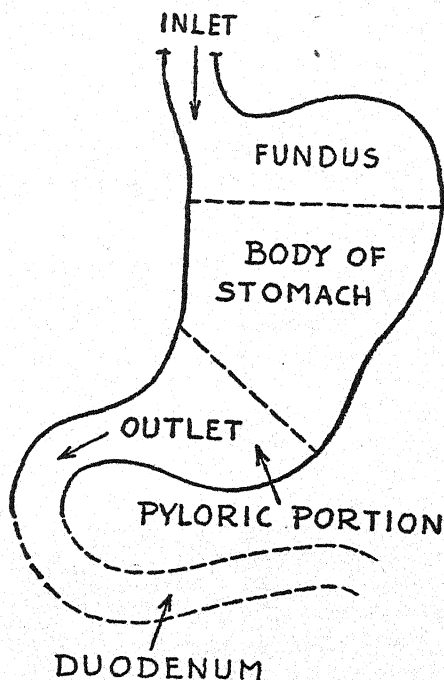
Mastication or Chewing—Another group of functions closely associated with salivary digestion is that comprising mastication. To masticate properly one should have a normal mouth cavity. This, above all, calls for the presence of good teeth. Absent teeth or poor teeth invite poor mastication. For the same reason, the muscles of the jaws and face, and the tongue and palate, should be in a normal state of health. Disability of any of the organs of the mouth cavity may invite digestive disturbances and therefore deserves proper investigation.

Deglutition or Swallowing—Swallowing is another important digestive function, and one not so simple as it appears. It is usually considered in two phases:

The *first phase* embodies the movement of the tongue and a group of other muscles above the level of the Adam's apple (thyroid cartilage) in the throat. The tongue, beginning with its tip, presses firmly against the palate, pushing the food backward toward the throat. As the food reaches the back of the throat, this space is closed above by the palate; the larynx below, which leads into the lungs, is covered by the epiglottis (saddle-shaped plate of cartilage). As a result, food passes over this protecting roof of the larynx into the gullet, thence onward to the stomach. Regurgitation of food upward into the nose is prevented by the protecting palate.

The *second phase* of swallowing is concerned with the transmission of the food from the throat into the gullet and through the gullet itself by means of inherent contractions of its muscle wall, which propels the food onward. This second stage of swallowing must be regarded as a reflex or involuntary function, whereas the first phase of swallowing is regarded as a willful or voluntary act. The esophagus or gullet is the beginning of the true digestive tract and transports food from the throat to the stomach. It is about nine inches long, extending from the throat to the stomach, and is tubular in shape. The act of swallowing is rather complicated and for its completion involves nervous influences from the throat and gullet as well as from the brain.

Stomach—The stomach is saclike in shape, and consists chiefly of muscular and lining tissue into which the gullet leads. The greater part of this organ is situated in the left side of the upper abdomen, some of it in the middle upper abdomen, and the smallest portion in the right upper abdomen, and leads into the first portion of the small



Showing approximately the divisions into which the stomach is divided and the duodenum into which it leads.

intestine, known as *duodenum*. The stomach, therefore, is continuous above with the gullet, and below with the duodenum; it has rather a large capacity and frequently holds large quantities of food. In the wall, at the point where the gullet and the stomach meet, there is a circular layer of muscle tissue which acts as a sphincter (shutter). This shutter is called the *cardia* and is often spoken of as the cardiac end of the stomach. The opening and closing of the upper end of the stomach takes place through the activity of this shutter. Often affections of this part of the stomach give rise to distressing symptoms, due

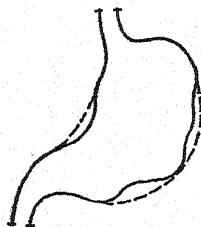
to a hindrance of the passage of food from the gullet into the stomach.

In order to understand the function of the stomach, we may assume it to be divided into two portions: the upper or cardiac portion (body of the stomach); and the lower or pyloric antrum, which by way of the lowermost end of the stomach (the pyloric canal, or pylorus) is continuous with the uppermost small intestine (duodenum). The *cardiac portion* of the stomach contains most of the secreting cells of this organ (tissues which elaborate stomach juice), and here thorough digestion begins to take place. In the *pyloric portion* of the stomach the food is given mechanical treatment (grinding and churning). To perform this function, the walls of the pyloric part are much thicker and more muscular than those of the body of the stomach. As a matter of fact, the musculature of the stomach, which is fairly thin in the upper portion, gradually increases in thickness as it descends toward the stomach outlet. Again, at the lowermost end of the stomach, the *pylorus* proper simulates the upper end of the stomach, in that the musculature and lining form a sphincter which acts as a shutter to control the elimination of the contents of the stomach. When this outlet is functioning naturally, food leaves the stomach in normal fashion, but when this shutter is functioning improperly food may be either retained in the stomach for longer periods of time than normal, or eliminated sooner than it should be, depending upon the nature of the disturbance affecting this outlet.

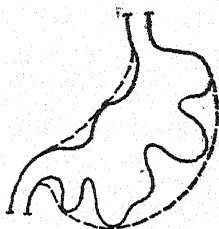
In addition to the muscular and secreting layers which constitute the stomach wall, there are also nerve elements which control the function of this organ. The chief nerve supply of the stomach and bowel tract is derived from the so-called *vegetative* or *autonomic nervous system*, which consists of two main divisions—the *vagus* and *sympathetic* nerves. These nerves directly, and through certain influences originating from the brain, control in great measure the functions of the digestive organs. Food, after undergoing digestion in the body of the stomach, is propelled onward by muscular contractions known as *peristaltic waves*. The waves vary in depth and frequency in various parts of this organ, becoming gradually less as they approach the lowermost part of the stomach. This function of contraction, however, serves the purpose of propelling the food onward into the intestine, where movements of a similar nature exercise themselves in the onward propulsion of the food mass. In certain diseased conditions an exaggeration of these muscle movements characterizes a condition often spoken of as "hunger pains." On the contrary, in some conditions due to a depressing stimulus such as arises in cases of mental distress or anxiety, there is

a definite diminution or cessation of these muscle movements. In other words, in instances of "hunger pains" the stomach exhibits too much tone; in certain other cases there is not enough tone to the stomach wall.

The secretion elaborated by the cells in the body of the stomach consists chiefly of *pepsin*, *rennin*, and *hydrochloric acid*; the first two are



NORMAL
CONTRACTIONS

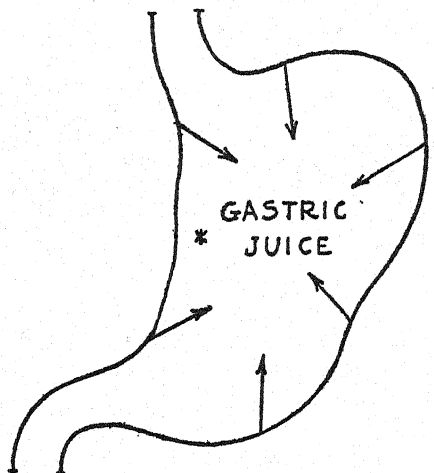


HUNGER
CONTRACTIONS

The stomach wall shows moderate muscular contractions ordinarily. During pronounced hunger, these contractions are both stronger and deeper.

ferments which aid in the digestion of protein foods, and the hydrochloric acid aids in the dissolution of the framework of the food elements. Thanks to the original studies of the American army surgeon William Beaumont, and the experiments of the Russian physiologist Ivan Petrovich Pavlov, we know that the secretion of the stomach juice is a reflex process arising in the nervous system. The first stimulus to the secretion of stomach juice is psychic in origin. Experiments have been performed which have shown that the mere exhibition of food to an animal will produce a flow of stomach juice or gastric secretion. However, for this stomach secretion to be maintained for a period of time, it is necessary that the animal be given food to gratify his appetite. Dr. Pavlov, through a so-called sham feeding experiment, fed the animal food which was then chewed and swallowed in the usual manner but never reached the stomach, having escaped through a gullet fistula or false opening to the exterior. He was able to show that the stomach began actively to secrete juice immediately after the food was offered and taken into the mouth. This proved that the secretion was brought about through a reflex nervous influence which involved

the mind as well as the local nerves controlling taste, smell, and chemical and mechanical stimulation within the mouth cavity. Pavlov also showed that when food was not given to the animal, after he had been teased with it, the stomach would discontinue secreting; and that, if unappetizing food was offered, a secretion of stomach juice was not



* GASTRIC JUICE

1. acid
2. ferments
3. mucus

Indicating the pouring out of the gastric secretion from the wall of the stomach. The gastric juice consists of three chief components—dilute hydrochloric acid, ferments, and mucus.

brought about. Many of these early experiments have been confirmed by others, and our knowledge of the subject has been further increased. We now know that the rate of stomach secretion is proportioned to the palatability of the food eaten, and is dependent also on the chemical nature of the food itself. Predigested protein foods, for example, will call forth a quicker and more pronounced secretion than water, albumen (egg white), and starchy foods. The stomach is believed to secrete about one and one-half quarts of secretion daily.

It is not to be forgotten that a considerable amount of stomach secretion consists of mucus, which is chiefly produced in the lower

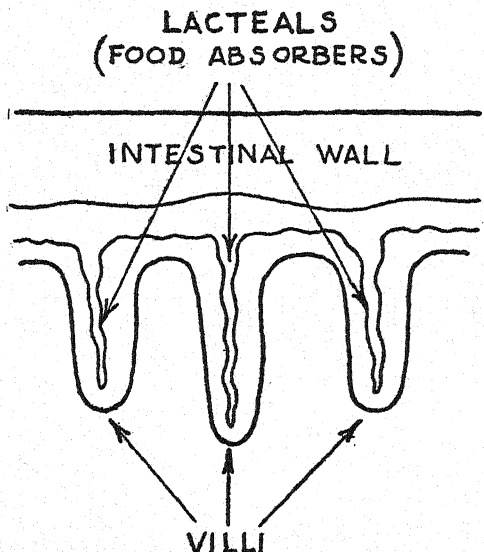
part of the pyloric portion of the stomach and aids in the grinding and churning of the foods and in protecting the stomach wall from the digestive power of its own secretion.

Various additional factors have been recognized as aiding in the production of stomach secretion, such as hormone influences and increased nutritional and blood supplies as well as reflex influences from adjoining organs, such as the intestine, liver, and bile tract. The main purpose of the stomach, however, is to receive the food from the gullet, subject it to digestion chiefly through hydrochloric acid and the ferments, pepsin and rennin, and then evacuate its contents into the small intestine. The *pylorus*, or stomach outlet, is endowed with regulated control, which permits the evacuation of the contents at intervals over a period of time, thus enabling the food to be properly digested and prepared before further treatment in the bowel is effected. This regulation of pyloric control is believed to be directly associated with the chemical character of the food itself as well as with certain nerve influences presiding over the outlet.

The Bowel—The *duodenum* is the uppermost portion of the small intestine and is about ten or twelve inches in length. It is located in the right upper abdomen in close proximity to the liver, gall bladder, and pancreas. It is a very common site of disease, especially ulcer. The movement of the food contents proceeds rapidly through this organ, especially through its lower two-thirds. For that reason X-ray observation of the duodenum is much more difficult than is that of the stomach. Nevertheless a fluoroscopic (X-ray illumination) observation of the first portion of the duodenum is made quite satisfactorily. The duodenum might be considered as a bridge between the stomach and the absorptive portions of the small intestine; the latter organ continues on as jejunum and ileum. The *jejunum* comprises about two-fifths of the remaining small intestine, and the *ileum* makes up the balance. It is into the duodenum that the liver secretion known as bile empties via the bile duct, and it is here also that the digestive secretion obtained from the pancreas empties. In addition, it is believed that certain local secretions from the duodenal wall itself are elaborated. All these digestive secretions coming from the liver, pancreas, and duodenum continue to act upon the food as it enters this organ from the stomach. Digestion is continued and the material is passed along to the lower portion of the small intestine, where further digestion and absorption take place.

It is in the small intestine, particularly in the jejunum and ileum, that absorption of the food elements occurs and the products of diges-

tion enter the blood and lymph vessels. Within the wall of this portion of the small intestine are found the *villi* (the chief absorptive areas of the intestine). It is through these that absorption occurs, and the intestines, in order to facilitate digestion as well as absorption, respond in pendular and kneading movements. The loops of gut sway from side to side, and these movements massage the blood and lymph ves-



Villi are elevations of the lining of the small intestine which contain, within their center, lacteals (lymph vessels) which absorb as well as convey the end products of digestion to other parts of the body.

sels within the walls of the intestines, thus encouraging absorption and facilitating the passage of the food elements into the blood. In addition to these kneading and pendular movements during digestion and absorption, there are also other intestinal movements which are spoken of as *peristalsis*; these are chiefly concerned with the onward movement of the bowel contents. The peristaltic movements are characterized by a slowly advancing wave of contraction, preceded by a relaxation of the walls of the intestine; this process continues throughout digestion. In addition, there is a swift movement which sweeps the food onward for a much longer distance. This is called the *peristaltic rush*.

As in the case of the stomach, it is known that the intestine is influenced to a considerable extent by the nervous system. But nervous influence is not ordinarily so apparent here as in the stomach. There are instances on record, however, in which anxiety and other neurotic influences have definitely produced intestinal disturbances of one form or another.

Large Intestine—The large intestine extends from the termination of the ileum to the *anus*, or outlet of the bowel, at the surface of the body. It is about five feet or more in length. Its greatest diameter is at its commencement (the cecum), gradually diminishing until it reaches the rectum, where again it becomes considerably dilated; this enlargement at the lower end is arranged by nature so that this portion of the large intestine may act as a reception point for body excrement immediately before its evacuation. The *cecum* is a large blind sac, or pouch, which begins in the right lower quadrant of the abdomen; with its open end directed upward it continues as the ascending colon as far as the under surface of the liver. From here it bends abruptly inward to the left, forming an angle known as the *hepatic flexure*, and continues across the abdomen to the left upper quadrant of the abdomen, where again it forms an angle curving downward; this angle is known as the *splenic flexure*. The transverse portion of the colon, running from the right to the left side of the abdomen, is spoken of as the *transverse colon*. The colon then continues in its downward course to the rectum, and this part is spoken of as the *descending colon*. Just above the rectum is the narrowest portion of the colon, often referred to as the *sigmoid flexure*. The *rectum* extends from the sigmoid flexure to the anus, or outlet. It is widest above and narrowest below as it approaches the anus. The lowermost inch of the bowel, extending from the lower rectum to the anus, is spoken of as the *anal canal*; this is lined both with *mucosa* (lining of the inner bowel above it) and with skin.

The *appendix*, with which nearly everyone is acquainted, is usually a long, narrow, worm-shaped tube or organ. It springs from the inner side of the cecum near its junction with the small intestine. The function of the appendix is not definitely known. Many authorities believe that it has no value and is merely the remains of an organ used countless generations ago. Others, again, feel that it still has some function, possibly hormonal or otherwise, and presume that it facilitates bowel movement. This is the organ, so frequently found diseased, for which countless thousands of operations are performed yearly.

At the junction of the lowermost part of the small intestine and the

beginning of the large intestine, there is a valve-like arrangement called the *ileo-cecal valve*, which is believed to have a regulatory control over the emptying of contents from the small into the large intestine.

The walls of the large intestine have a similar type of structure throughout, but in appearance they are sufficiently different to enable one to distinguish one portion from another. The lining coat of the bowels is referred to as the *mucosa*, but it also has within its wall *muscular* and *connective tissues*. In addition, these organs all have an adequate supply of blood vessels and nerves.

In contradistinction to the rather active movements which characterize the small intestine, the colon is rather slow in activity. After the bowel contents pass through the ileo-cecal valve into the large intestine, the pressure upon the bowel walls stimulates muscular action and causes the large intestine to undergo contraction, as a result of which slow wave-like movements force the contents onward. Moreover, there are other forms of contraction set into motion which have, as their purpose, the kneading and mixing of the bowel contents, as a result of which water and other fluids may be absorbed. The more solid portions of the bowel contents are separated from the liquid portions and are moved onward by transverse waves of constriction, until they finally reach the lower portions of the colon or sigmoid flexure; here they remain for a period of time, as in a reservoir, before they are transported to the rectum for a short stay prior to evacuation.

Absorption of the greater part of our food occurs in the small intestine, but a considerable amount is absorbed also in the large intestine, especially those foods which have not been sufficiently broken down into their simpler products in the upper small intestines.

Defecation or Bowel Movement—The act of defecation is believed to be a combined voluntary and involuntary act. Authorities feel that a nerve center located in the lower portion of the spinal cord controls it. It is assumed that, when the fecal excrement enters the rectum in sufficient quantity to produce a sense of distention or irritation, the *spinal nerve center* is aroused; as a result, the involuntary phase of defecation is set in motion and the intestinal contents of the descending colon and sigmoid flexure begin to enter the rectum. The act is then completed by the contraction of the abdominal *diaphragm* muscles, in consequence of which the increased pressure within the abdomen aids in the ejection of the contents from the sigmoid flexure and in their further expulsion from the rectum to the exterior of the body.

The Liver—The liver is the largest gland in the body. It is situated in the right upper section of the abdomen, and measures from eight to

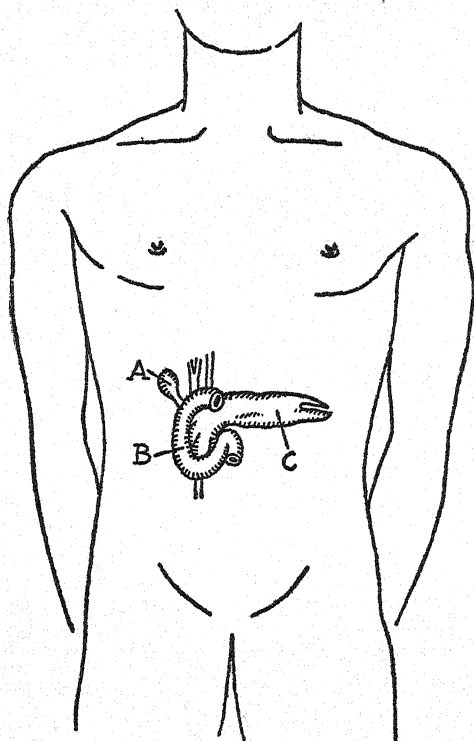
nine inches across; its vertical height is about six or seven inches. Although a solid organ, the liver is quite soft. It is divided into two main portions, the *right* and *left lobes*. Because of its exceedingly rich blood supply, it bleeds very easily when lacerated. It is an important organ and is probably more concerned with metabolism than is any other organ of the body. It has many activities, such as its storing up of carbohydrates within its tissues, its blood-forming function, its connection with the metabolism of the protein foods, its detoxifying functions, its association with the maintenance of body heat, and its connection with the formation of *bile*, an important digestive substance.

The quantity of bile secreted by the liver is about half a liter or more every twenty-four hours. It varies in accordance with the amount of food eaten and with the character of the food. One of the chief functions of the bile is to assist in the digestion and absorption of fats. Bile is also believed to have a slight laxative influence on the bowels and to enhance the power of other digestive secretions.

Gall Bladder—The gall bladder is a conical or pear-shaped hollow organ, located just under the right lobe of the liver. It is about four inches in length and one inch in breadth, and normally has a capacity of one ounce or more. It is connected through a small duct (*cystic duct*) with a larger *hepatic duct* leading out from the liver to form the common bile duct, which empties into the upper small intestine (*duodenum*). It is not uncommon to find within this duct the causes of jaundice, such as stones or adhesions. The gall bladder is presumed to store a certain supply of bile within itself, for satisfying the demands which arise during digestion. Its emptying and refilling are controlled by nervous factors. After digestion has occurred, the gall bladder begins to refill in order to serve again as a reservoir for the storage of bile for future use.

The Pancreas—The pancreas, or sweetbread, is an organ with which many epicureans are acquainted. It is irregularly prismatic in shape, and very much like a dog's tongue in appearance. It has two main secretions, the *external* or *digestive secretion* and the *internal* or *hormonal secretion*. The latter is particularly concerned with the control of carbohydrate metabolism, a disturbance of which results in the condition known as diabetes. The digestive secretion is collected and eliminated through the pancreatic duct leading to the duodenum, into which it is emptied for digestive use. This secretion consists chiefly of three main ferments: *trypsin*, which splits the proteins into the end products of digestion; *steapsin*, which digests the fats; and *amylase*, which is concerned with the splitting of starches into sugar. It is be-

lieved that the secretion of the pancreatic juice may be aroused from different sources: the *psychic* (mental), by the mere suggestion or thought of food; the *hormonal*, by absorption of certain elements secreted by the stomach and intestinal lining, which in turn through the



A indicates the gall bladder.

B indicates the duodenum as it surrounds the head of the pancreas.

C points to the tail of the pancreas.

blood stimulate the flow of the pancreatic juice; and, finally, by other *nervous* influences which act upon the cells of the pancreas through direct stimulation.

Peritoneum—The peritoneum is a protective organ or covering with a large surface which envelops most of the organs within the abdomen. By virtue of its abundant circulation and the character of the tissue which makes up its surface, the peritoneum responds readily to insults

or accidents which may befall it or the organs within the cavity which it envelops. It is believed that the peritoneal covering secretes a fluid which keeps the organs in the abdominal cavity moist and lubricated, so that these organs may oppose or glide over one another without creating damage. It is also assumed that the cells lining the peritoneum have not only the power of absorbing any material which may suddenly enter the abdomen, but also the faculty of protecting the body from infection, as is commonly evidenced by its localization of infective processes—as, for instance, in the case of localized peritonitis, a condition which commonly complicates acute appendicitis.

The peritoneum, by virtue of its sensibility, aids the physician in his interpretation of diseased conditions. Sensitiveness within the abdomen is much increased when the peritoneum is inflamed.

In addition to the peritoneum, another protective organ within the abdomen, attached to the edges of the various visceral organs, is the *great omentum*. This organ seems to seal any perforations that may arise within the other viscera, such as the stomach or appendix, by attaching itself about the damaged area, thus localizing infection and limiting inflammation.



CHAPTER II

The Significance of the Medical History

IN ORDER to arrive at reliable conclusions regarding the nature of any digestive disorder, it is necessary for the physician in charge of the case to utilize such methods of investigation as will open up or unfold the problem to him. In other words, a complexity must be simplified through the process of analysis and proper interpretation.

An investigative procedure of great value is *history taking*, which consists in ascertaining and appraising the answers given by the patient to many leading, direct, and indirect questions. The chief or outstanding complaint may be nausea, diarrhea, constipation, or pain in some portion of the abdomen; this usually has great significance and during further questioning must be borne in mind and correlated with other data elicited.

Family History—The family history reveals hereditary predisposition, racial traits, familial ailments, and diseases which may have been acquired through transmission during birth or by familial contact. These factors may have a general or specific relationship to the outstanding ailment with which the patient is afflicted. Such diseases as tuberculosis, syphilis, allergy, and diabetes are conspicuous examples.

The habits or mode of living may have a strong bearing upon the ailment. Improper eating and irregular hours, the drinking or eating of irritating foods, improper rest and inadequate sleep, excessive mental or physical exertion or irritation, indulgence in such pursuits as overtax the nervous system, and disorders in sex expression, menstruation, and the habit of arousing bowel movement may all have an important part in the development or maintenance of the chief disorder and are questions to be answered.

Past Medical History—The past medical history may have an important relationship to the existing disorder. Any previous infection may have had some influence in the development of infection in the digestive system. Typhoid fever is believed in many instances to have

predisposed the victims to later attacks of gall-bladder disease and intestinal catarrhs. Allergic tendencies, tuberculosis, and kidney and heart diseases are believed occasionally to have invited digestive disturbances, and certainly no one questions the influence of nervous irritability in that direction. As a matter of fact, any rather serious constitutional ailment may have left the digestive system in a debilitated state, or in a condition which invites the development of local stomach or bowel disorders.

It is also important to inquire into the previous existence of either casual or persistent symptoms, such as headaches, dizziness, fever, shortness of breath, urinary disturbances, cough, visual disturbances, and the like, which may be directly or indirectly related to the digestive ailment or other influencing conditions. Certain types of headache may indicate a brain disease, with which reflex stomach disturbances are usually associated. Shortness of breath may point to the existence of a heart ailment, with which digestive disturbances are frequently allied. Dizziness may prove to be due to ocular disturbances, with which reflex stomach and bowel disturbances may be connected. And so on, down the list. All symptoms have a significant bearing upon diagnosis if properly interpreted. Even more significant is a past history of attacks of indigestion or abdominal colic, which may indicate the previous existence of digestive disease and, therefore, a strong likelihood of its recurrence in a similar or aggravated form.

History of the Present Illness—Of even greater value in the appraisal of the story furnished by the patient is the history of the present illness. Inquiry must be made into the duration of the present complaint, its manner of development (suddenly or gradually), whether it has been interrupted or constant in its manifestation, the intensity of the symptoms with or without relief, and whether it is local or general in character.

Inquiry as to the nature of the appetite, taste, breath, and swallowing and as to the existence of such symptoms as regurgitation of food, belching, heartburn, bloating, nausea, vomiting, hiccoughs, and pain may lead to valuable information.

In certain ailments (such as nervous conditions) the appetite is often poor, whereas in other conditions (such as duodenal ulcer) it may be increased. Foul breath is a common accompaniment of liver or gall-bladder ailments and constipation. Difficulty in swallowing is a common symptom of diseases of the gullet or of organs in the neighborhood of the gullet, or may even be a reflex expression of disease in a distant organ such as the gall bladder. Regurgitation, heartburn, belch-

ing, and bloating may all be due to stomach irritation as a result of disease within the stomach proper or reflexly from other diseased organs, such as the duodenum or some other portion of the intestine, the gall bladder, or the liver. Frequently general nervous irritability or mental tension may affect the nerves controlling stomach action and give rise to the above symptoms.

Nausea and vomiting may also result from nervous, toxic, and reflex influences in the stomach arising from local or remote ailments. The character of the vomiting also has significance; if it gives relief to the patient, it may serve as a clue to a proper diagnosis. Aggravation of symptoms by vomiting likewise may point to other conditions. Hiccough, especially if persistent, may indicate either a nervous or organic ailment in the neighborhood of the diaphragm. This occurs in liver, gall-bladder, duodenal, and stomach diseases, and also in individuals of nervous disposition.

The presence in the vomitus of food elements, bile, blood, excessive mucus, and so on may serve to unravel the problem confronting the physician, and a proper, thorough questioning in detail as to the component make-up of the vomited material is therefore essential.

Pain—Irrespective of its degree, pain is a very important symptom, an understanding of which may serve to interpret properly the nature of the disease in question. It may vary from a feeling of minor discomfort, pressure, heaviness, or achiness to that of a true pain. Its location in the abdomen and its relation to meals may also give significant information. In order to appraise this symptom, it is important for the physician to have a thorough knowledge of the individual registering the complaint, because individuals vary in their psychic and sensory make-up. Some persons will exaggerate their complaints, and others will minimize them, thus misleading or attempting to mislead the inquirer.

The more severe the pain, the more irritable the functions of the stomach or intestines. An increased irritability of the stomach usually implies an exaggerated sensitiveness of one or more of the various functions, such as the sensibility of the lining of this organ, the motor activity of various portions of the stomach, the secretion of acid and ferments, peristaltic activity, and evacuational integrity. These functions may be affected singly or in various combinations, and may be either purely nervous or organic in origin. In other words, similar symptoms may occur in a neurotic person as take place in a victim of an ulcer or a growth involving the stomach. For that reason, data ac-

quired from many angles must be correlated and properly evaluated.

Certain symptoms, however, are frequently significant of certain ailments. Pain in the pit of the stomach immediately after meals often indicates a functional disturbance in the stomach; pain one to three hours after meals may point to the existence of a duodenal ulcer (lesion in the duodenum) or of gall-bladder disease.

The *location of the pain* is also of importance, for we know from experience that prominent manifestations of pain in certain areas of the abdomen often suggest the definite involvement of certain organs. For example, pain in the right lower quadrant of the abdomen may frequently point to disease of the appendix, but less frequently it may result from a disturbance in the ascending colon or disease in the lowermost portion of the small intestine. In the same way, distress over the left side of the abdomen, low down, may indicate disease within the lower portion of the large intestine above the rectum. Of course disease of other organs, such as the ovaries and kidneys, may also produce pain in certain portions of the abdomen; through further questioning this symptom will be better understood and related to the proper source of the irritation.

If the pain or discomfort is in the *epigastrium* (pit of the stomach), the disease likely has its origin in the stomach, liver, gall bladder, duodenum, or pancreas. At times exceptions to the rule may prove that this abdominal region reflects symptoms resulting from disease in more distantly located organs. The value of this symptom is enhanced when it is correlated with other factors such as the time of occurrence of the pain or distress.

So it is with all symptoms of pain or discomfort in the abdomen. When elaborated upon and studied in relation to other factors—such as their time of occurrence, their association with meals, the character of the distress and its spread or radiation—they become better understood and have significance in determining a diagnosis.

Pain occurring immediately after eating often points to a purely nervous or functional disturbance in the stomach or the uppermost part of the intestine. Pain coming on one or more hours after meals will more likely be due to organic disease of the stomach, the uppermost portion of the intestine, or the gall bladder, but exceptions to this rule are not uncommon. The more sensitive patients may exaggerate symptoms and throw the physician off the track. It is therefore essential that the physician properly appraise the mental state of every patient he questions. A so-called neurotic person or hypochondriac

may give the inquisitor many false leads which proceed either nowhere or in the wrong direction. The experienced physician knows this and is therefore on his guard.

Pains occurring with *regularity* and in definite relationship to meals, either before, during, or at certain periods after meals, are most likely to be digestive in origin, that is, occurring in some organ of the digestive system, such as the gullet, stomach, duodenum (uppermost small intestine), gall bladder, pancreas, liver, or appendix, or in portions of the bowel tract. On the other hand, when pain or discomfort occurs without regularity and with no definite relationship to meals, the conditions causing it are probably not digestive in origin and may prove to originate from disease of such organs as the kidneys, the bladder, or the ovaries, Fallopian tubes, or other generative organs, or from diseases of the nervous system.

The *character of the pain* also aids the inquirer in his proper interpretation of the condition. Ulcers or lesions of an ulcerative character will usually produce cramplike, gnawing, burning, or boring types of pains. Occasionally a purely spastic condition, not organic in nature, may produce a cramplike, colicky pain, but this is not the rule.

Colicky as well as nagging types of pain are common manifestations in gall-bladder disease, especially if the pain occurs in the right or mid-portion of the upper abdomen. Dull or boring types of pain frequently arise in the upper abdomen in ulcer of the stomach and ulcer of the duodenum. Pains in the middle of the abdomen are usually due to disorders in the small intestine, and pains in the lowermost mid-abdomen may be the result of disorder in the large intestine.

Pain appearing late after the meal or before the next meal is a common occurrence in duodenal ulcer, and the so-called hunger pain is often indicative of this condition. These same types of pain may also be found frequently in gall-bladder disease and in complications of other diseases affecting the stomach and duodenum.

The *effect of foods* in the production of distress or indigestion may also prove of benefit in our investigation. Some individuals are allergic to fish, milk, or meats. In certain conditions liquids produce distress. Foods that are iced or very cold bring about spastic disturbances in other persons. Heavy or coarse foods act as irritants in cases of ulcer or catarrh of the stomach and duodenum. Starchy foods disagree with many gall-bladder patients; on the other hand, meats and fats sometimes disagree with others.

Seasonal influences are known, from experience, to influence the production as well as the recurrence of symptoms in cases of digestive

diseases. This seems to be particularly true of ulcer of the stomach or duodenum. Some individuals develop symptoms in the autumn and winter, others in the spring and summer. Some gall-bladder cases likewise have such seasonal experiences.

Diarrhea—Looseness of the bowels, or diarrhea, as it is most frequently called, is often the outstanding symptom of which the patient complains. It becomes the problem of the physician to determine whether this symptom is purely *digestive* in origin or due to some other condition. So-called *non-digestive* causes may be found in tropical ailments (dysentery, hookworm disease), in acute febrile diseases (typhoid, malaria), in disturbances of the endocrine gland system (thyroid, pituitary), and in purely nervous diseases. In digestive disturbances, diarrhea will often be a prominent manifestation because of local irritative influences upon the bowels, resulting from dietary indiscretions, irregular modes of living, exposure to cold weather, and cold drinks. Disorders of function particularly involving the secretion and motor activities of the stomach, bowels, pancreas, and liver sometimes produce diarrhea. Other causes may be found in such toxic processes as ptomaine poisoning, and in infections of the bowels by organisms (as in dysentery) or by parasites (such as tapeworm).

Certain *nervous ailments* and *psychotic states* also may result in frequent loose bowel movements, as was the case with many people during the great financial depression several years ago. More frequent causes of diarrhea, however, are local diseases within the digestive tract, such as ulcer and catarrh of the stomach and duodenum, diseases of the pancreas, certain forms of colitis (catarrh of the large bowel), and benign and malignant processes involving the intestinal tract.

Constipation—When this symptom is outstanding it may have leading significance. If it is *chronic* (of long standing) it may not point to any serious or dangerous disorder, but may merely indicate an old form of constipation due to a chronic spastic irritation of the musculature of the large intestine, or to a loss of tone power on the part of the muscle layers of the large bowel. In some cases it is the result of a loss of responsive power on the part of the sensory nerves in the lower bowel and rectum, in consequence of which the defecation reflex is not easily aroused. Often chronic constipation results from diseases in the lowermost part of the rectum, near the anus, as in hemorrhoids (piles), fissures (cracks or ulcers), strictures or spastic manifestations near the anus, polyps or simple growths and malignant growths in the lower rectum. Occasionally it occurs in people who for years have eaten improperly, not having had adequate amounts of food with which to

form a large masslike excrement to stimulate movement or enough fruits containing sufficient amounts of laxative material to encourage bowel activity.

Constipation which comes on suddenly, or as an *acute* manifestation, may be of more serious import. It may only be a purely spastic process of nervous origin and not dangerous, but it also may be quite serious and indicate one of many possibilities, such as a twisted or kinked bowel, severe adhesions to the intestine, benign or malignant obstruction, impaction of feces in the bowel, or thrombosis of the blood vessels supplying the intestines. A proper examination will, of course, aid in the recognition of the cause of this condition.

Non-digestive Symptoms—Other symptoms not necessarily characteristic of disturbances in the digestive system frequently assume prominence in the complaints of a patient suffering from a digestive disorder. This may be a *reflex* expression of involvement of some portion of the body not directly allied to the digestive apparatus, or it may indicate the existence of an entirely separate ailment.

COUGH—Cough, for instance, may be a reflex expression in certain abdominal ailments especially when the upper abdomen is involved in close relationship with the diaphragm (partition separating chest from abdomen). On the other hand, it is more often an expression of disease in the respiratory system or in the heart and its large vessels.

DYSPNEA—Dyspnea, or *shortness of breath*, may occur in diseases involving certain abdominal organs, as a result of which there is a pronounced increase in tension or pressure within the abdomen, causing interference with the movement of the diaphragm. This occurs in cases of large tumors and also in instances of enlargement of the liver or spleen. More usually, it indicates a disease of either the heart or the respiratory organs.

PALPITATION—Palpitation of the heart may at times be a reflex expression of digestive disorders, but more often it indicates a heart disturbance or nervous affliction. It is also associated with hyperthyroidism (excessive activity of the thyroid gland).

HEADACHE—Headache may be a reflexly produced symptom of digestive disorders, as in stomach upsets, liver dysfunction, or intestinal toxemia, constipation, and so on, but more frequently it results from eyestrain, from disturbances of the nose and throat, the kidneys, or the heart, or from endocrine affections.

In the same way, other symptoms of considerable significance may lead us to the recognition of complicating ailments.

EXPECTORATION OF BLOOD—Expectoration of blood may indicate

hemorrhage from the lungs as in tuberculosis, or from the throat or nose as in blood diseases.

CHILLS—Chills may suggest a fever or the ushering in of such a condition, or an auto-intoxication, or merely a nervous reaction.

SWEATING—Sweating, especially at night, and hoarseness of the voice may suggest diseases of the lungs or throat or glandular disturbances.

DISTURBANCES IN URINATION—Disturbances in urination may indicate bladder, kidney, or other afflictions of the urinary tract, or at times diabetes.

EDEMA—Edema, or dropsy, may be the clue to heart, kidney, or circulatory diseases.

LOSS OF WEIGHT—Loss of weight often provides information as to the general nature of the disease and its effect on body metabolism and nutrition.

PULSE RATE AND TEMPERATURE—Pulse rate and temperature also have great value in the appraisal of an individual's condition.

CHAPTER III

Information Furnished by the Physical Examination

ALTHOUGH in this book we are interested primarily in matters pertaining to the digestive system, in our consideration of the abdomen it is of vital importance not to limit the objective examination to this area only, but to consider the entire body in order that a proper appreciation of the physical and functional nature of the digestive organs may be attained.

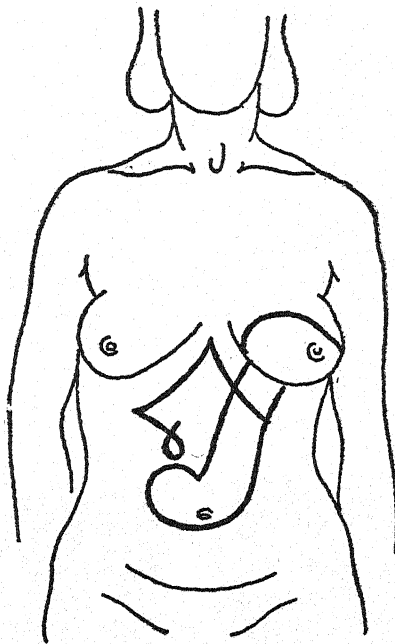
One of the first general observations should pertain to the body type or general *body build*. This is spoken of among medical men as the *body habitus* and involves the factors of height, weight, shape, and body conformation, as well as of body tissue nutrition. Three types are usually referred to: first, the so-called average, well-developed type or *habitus sthenicus*; second, the so-called underdeveloped type or *habitus asthenicus*; and, third, the overdeveloped type or *habitus hypersthenicus*. Some authorities associate the occurrence of certain ailments in individuals with their type of build. Asthenic individuals frequently develop nervous disturbances and such debilitating diseases as tuberculosis. Hypersthenic people often develop circulatory ailments and gall-bladder diseases.

The *posture* of the patient must also be studied. A person who holds himself well and appears strong usually has no serious underlying disease, whereas one who appears listless and bent, or who lacks agility, may have a more serious factor underlying his indisposition. An abnormal walk or gait may reveal a serious constitutional disease or a nervous affliction which indirectly affects the digestive organs. Such diseases as late syphilis, hysteria, circulatory diseases, and brain diseases may cause variations of attitude and posture which serve as valuable clues to further medical enlightenment.

The *facial expression* may give evidence of actual physical or mental suffering or the existence of fever. Flushed cheeks are seen occasionally in affections of the lungs, particularly tuberculosis and pneumonia, and

in certain heart ailments. A cyanotic or bluish tinge of the face is noted in diseases of the lungs and heart. Certain facial characteristics are seen in peritonitis, in endocrine gland diseases, and in paralytic or brain affections.

The *general appearance* in relation to age is an index of value in judging the physical welfare of a person. People who look rather young for their age are usually free from manifestations of senile disease. On



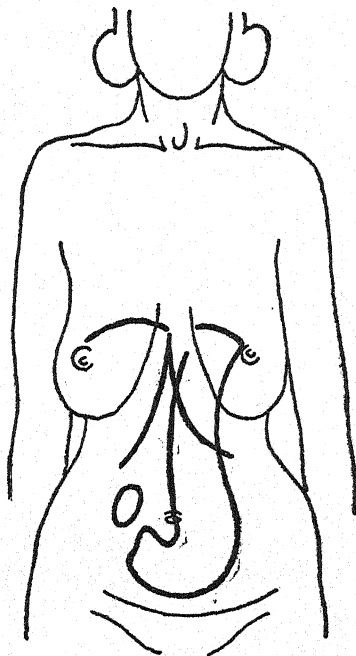
Sthenic type of build which portrays the stomach as comparatively broad and short. The upper abdomen is fairly wide.

the other hand, those who look older than their age often have arteriosclerosis or other evidences of senile deterioration. It is possible, of course, that suffering, physical or mental, may have contributed to the development of an older appearance.

The *position* or *body attitude* in which an individual is disposed habitually to present himself may be an index of the existence of certain ailments. A heart patient is more comfortable in an upright position and sleeps better when not reclining too low. In general peritonitis,

one or both thighs may be flexed to reduce tension within the abdomen. In appendicitis, the right thigh is often found flexed upon the abdomen, and in certain forms of "belly ache" the patient gets relief by lying upon the abdomen. These are just a few examples of body attitude which carry significance.

A general physical examination of the entire body before limiting observation and inspection to the abdomen, the mouth, and the rectum



Hyposthenic type of build which portrays the stomach as relatively narrow and long. The upper abdomen is rather narrow.

is of importance if thoroughness is to be adhered to. This includes an examination of the entire body as to conformation, muscle development, and symmetry. The condition of the eyes, ears, nose, throat, and teeth is exceedingly important and may furnish data having a definite bearing directly or indirectly upon the outstanding ailment. The condition of the neck, of the chest, including the heart and lungs, of the blood circulation and blood pressure, as well as of the nervous system is likewise no less important and should be included in the examina-

tion before special studies are made aiming directly at the digestive system.

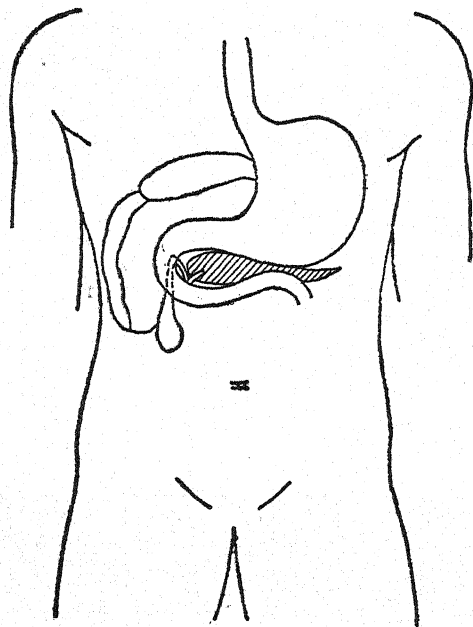
Abdominal Inspection—The *size, shape, and tone* of the abdomen will, at times, furnish information of value pertaining to conditions within its cavity. The abdomen is usually symmetrical; therefore when asymmetry is noted an abnormal condition is suspected. Unusual distention may be due to accumulations of gas within either the stomach or the intestines. A tumor, an abnormal mass, or a mere enlargement of an organ may in a similar way loom up in certain parts of the abdomen and produce an asymmetrical appearance. In women who have given birth to one or more children, the abdomen may have become enlarged and its wall pendulous (tending to hang downward). In cases of low stomach or low intestines, often called "dropped stomach or dropped bowels," the abdomen may seem enlarged when compared with normal cases; and, of course, where tumors, inflammatory masses, accumulation of fluid (dropsy), or enlargements of organs exist, the abdomen nearly always appears to be enlarged. In individuals who are thin and of the asthenic type referred to above, the wall of the abdomen often has poor tone or reduced muscular support, probably because of a lowered state of general nutrition and poor muscular development resulting from insufficient exercise. In women who have had children, the poor tone of the abdomen often found may be due to overstretching of the musculature and incomplete return of the tissue to the normal state. When people lose a great deal of body weight (because of strenuous dieting or disease) they often have an accompanying loss of abdominal fat, and their body muscles—including the abdominal musculature—also become thinner; hence the abdomen may assume a new appearance, at times flattened or even scaphoid (depressed or boatlike) in contrast with the normal rotund abdomen.

Occasionally the upper part of the abdomen exhibits enlarged superficial veins to an outstanding degree. This usually indicates a retarded circulation of blood within the liver, due to disease either within the liver proper or within some organ near by. This venous enlargement may also be caused by some obstructive effect upon the larger vessels leading to and from the heart.

When the wall of the abdomen is rather thin, the observer occasionally may note the outline of parts of such individual organs as the stomach and colon—outlines created by the reflection of light upon the abdomen—and from time to time may see wavy movements in the abdomen wall which are produced by the so-called *peristaltic* activity of the stomach or intestines. These movements are seen either because

the belly wall is very thin, or because the movements are more violent than normal, or because of both factors combined. Violent stomach or intestinal movements occur usually because of some obstructive effect which the musculature of these organs attempts to overcome.

Vigorous pulsation in an abdomen often results from overactivity of the large blood vessel known as the abdominal *aorta*, and occurs in nervous people or in persons who have, because of the low position of



Showing the inter-relation of the liver, gall bladder, pancreas, and stomach.

the stomach and bowels, an exposed aorta. At times it is possible to see or feel the liver pulsate, especially when this organ is congested as in heart disease. In rare cases the abdominal aorta referred to above is dilated and enlarged, and also shows a tendency to pulsate.

The condition of the abdomen often referred to as *dropsy* is the result of an accumulation of fluid within the abdominal cavity. The pressure within the abdomen is increased and consequently the organs and vessels within the abdomen are compressed and give rise to various symptoms, one of which may be edema, or water-logging of the lower

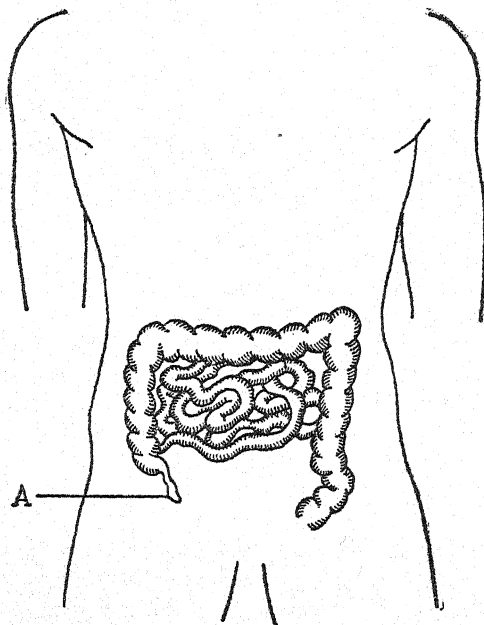
extremities (feet and legs). Dropsy often results from heart, liver, or kidney diseases in which obstruction of the circulation within the abdomen takes place.

Palpation of the abdomen is an art with many physicians; it is concerned with the process of feeling the abdomen with the palmar surfaces of the hands and fingers. By various manipulations in which pressure and relaxation of the hands and fingers are utilized, valuable information as to the physical condition of the abdomen and the organs contained in it may be obtained. Any findings of importance are then considered in relation to the part of the abdomen in which they are discovered, and are usually noted as applying to a certain abdominal quadrant.

The *quadrants* are sections into which the abdomen is divided by two perpendicular lines which cross each other directly over the umbilicus (navel). Four sections are formed and are known as the right upper and left upper quadrants, and the right lower and left lower quadrants. The upper part of the abdomen is bounded above by the *diaphragm* (already referred to in Chapter I), and below by a theoretical plane running through the brim or top of the true *pelvis* (lower part of the trunk of the body). Ordinarily it is assumed that in the average normal person certain organs, in full or in part, occupy these quadrants. In the *right upper quadrant* will be found the greater part of the liver, the gall bladder, the head of the pancreas, the right kidney, the hepatic flexure of the colon, a portion of the transverse colon, the pylorus portion of the stomach, and the duodenum. The *left upper quadrant* encloses the left portion of the liver, the left kidney, the spleen, the splenic flexure of the colon, a part of the transverse colon, the body of the stomach, the greater portion of the pancreas, and portions of the upper small intestine. In the *right lower quadrant* are found the ascending colon, the cecum, the appendix, and a portion of the small intestine. The *left lower quadrant* contains the descending colon, the sigmoid flexure of the colon, and a portion of the small intestine.

The physician who bears in mind the normal content of each abdominal quadrant will, after years of experience in palpating the abdomen, be able either to make a correct diagnosis or to have some idea of the probable nature of the ailment to be solved. Normally most of the organs can seldom be felt and are incapable of being outlined, but under abnormal conditions certain organs may be palpated. Of course large masses or growths may be felt, especially when the patient has lost weight and the abdomen has become quite thin. The examiner

should be able to differentiate between false masses, such as those due to gaseous accumulations or overloaded bowels, and true disease enlargements such as tumors. Enlargements due to rupture (hernia), pregnancy, or gaseous accumulations may readily be discovered and should not be confounded with other diseased masses. Dropsical en-



A indicates the appendix connected to the cecum (beginning of the large intestine) and the remainder of the large intestine, together with the many coils of small intestine embraced by it.

largements of the abdomen will be recognized through further investigation by employment of a maneuver known as percussion (tapping with the finger upon another finger laid on the abdomen) in conjunction with palpation. Tapping the abdomen brings out variations in the sound or note created by the impact; these variations depend on the condition of the abdomen. A solid organ emits a dull sound, a hollow, gas-filled organ gives a tone of higher pitch, and when fluid is present a dull sound is elicited.

By employing both palpation and percussion the examiner may gain

a fairly accurate idea of the size, position, and consistency of an organ and the nature of the disease affecting it. A special type of procedure is often employed to examine each organ at the particular portion of the abdomen in which the organ is expected to reside. Some of the organs frequently felt through the abdominal wall are: the border of the liver, an enlarged gall bladder, an enlarged or displaced kidney, an enlarged or dilated stomach or a tumor of the stomach, an enlarged spleen, a superficially located appendix, and either gas-filled, feces-filled, or otherwise enlarged portions of the large intestine.

One of the main objectives on the part of the examiner is to discover tenderness in certain parts of the abdomen; this fact, when correlated with other manifestations, has important value. Ordinarily, in normal people, an abdominal examination does not bring out pain or tenderness; in rare instances, however, when persons are exceedingly sensitive, even slight pressure upon the abdomen arouses a sensation of tenderness, especially in individuals who have thin abdomens or in cases of ptosis (dropped organs).

As a rule, tenderness or pain upon palpation of the abdomen carries significance and points to some form of disease, either functional or organic. When inflammation exists in the abdomen, a defense reaction is usually noted in the muscle tissue of the abdominal wall overlying the diseased area. The well-known sign of tenderness and rigidity at so-called McBurney's point in the right lower quadrant of the abdomen, most familiar to the laity in cases of acute appendicitis, is an example. The tenderness and rigidity over the gall-bladder region in the right upper quadrant of the abdomen in gallstones and gall-bladder catarrh is not a rare phenomenon. Tenderness over the upper mid-abdomen in stomach disturbances and in the mid-abdomen and lower abdomen in intestinal conditions is quite commonly observed. It must be stated here, however, before an erroneous impression is created, that these manifestations of tenderness and pain are not always located at these spots in the abdomen; for there are exceptions to every rule. That is why it is necessary to have a physician or experienced student of disease in attendance upon all cases.

The laity have no just authority to treat abdominal ailments. Fortunately many abdominal complaints, although capable of producing pain, are satisfactorily treated by medical means; but there are ailments of this type which if neglected may result in disaster to the patient. The physician is the only one authorized to pass judgment on an abdominal condition and to rule whether the case requires either medical, surgical, or dietary treatment or a combination of these measures.

CHAPTER IV

Mechanical and Allied Methods of Examination

Most of the organs of the digestive system are far removed from direct view. Even the lowermost portion is not accessible to the eye except through the use of a rectal instrument, which can be inserted after the anus is dilated. To render the investigation of the gullet, stomach, bowels, liver, and pancreas more accurate, it is imperative that certain mechanical procedures be resorted to.

X-ray photography and fluoroscopy have given us information of great value toward diagnosis, through illumination and photography of the shadow outlines of such concealed organs as the gullet, stomach, duodenum (upper small intestine), large bowel, and gall bladder. Other methods also furnish important information regarding the functions of some of these digestive organs, but they seem to be utilized only by specialists. Comparatively few men use the esophagoscope or gastro-scope to view the gullet and stomach directly, and few employ the rather expensive gastrophotor apparatus with which actual flashlight photographs are made of the lining of the stomach. Experts, by passing tubes of different sizes and forms into the stomach and duodenum, have been able to aspirate, or drain, from the stomach and duodenum, digestive contents which, after investigation and study, have furnished valuable data regarding the chemical nature, ferment activity, and cellular character of these organs and their secretions. Unfortunately, many physicians evade using most of these procedures, but do adhere to the use of X-ray photography and fluoroscopy, since these can be employed with little if any discomfort to the patient. This is a sad mistake, especially where the ailment has existed for a long period and does not respond to treatment. In such cases too much investigation is not the rule, but rather too little.

Esophagoscopy and Gastroscopy—These terms refer to direct observation of the esophagus and stomach (gastrum). This is accomplished by means of an illuminating instrument which can be adjusted

in its length for viewing the gullet and stomach. Such an examination must be performed only by an experienced physician who specializes in the art of handling this instrument and viewing the interior of the gullet and stomach without endangering the patient. Patients who have serious heart and lung diseases or other ailments of a general debilitating character are not expected to submit to this mode of study. Where no contra-indications exist, it may be done satisfactorily and will often furnish information not easily obtained otherwise. Instruments of various types have been employed in the past, and different techniques are resorted to by many men. Schindler has been successful in the use of this method and has been enabled to make diagnoses of stomach catarrh, stomach ulcer, and cancer in some cases which failed to show these findings by other methods. Another advantage in its use is that earlier recognition of lesions of the gullet and stomach may be attained by this means than by other methods.

Intra-gastric Photography—As the term implies, this is a method of photographing the interior of the stomach. The instrument which accomplishes this objective is known as the *gastrophotor*, and was developed by Back, a mechanical engineer, a number of years ago.*

The instrument is rather flexible, and has a camera located in the distal portion (tip inserted first) of a rubber tube which looks very much like the ordinary stomach tube. The end of the tube containing the camera is swallowed and directed into the stomach. This camera portion of the tube is metallic, and consists of an upper and lower section with a small incandescent lamp interposed between them. Instead of lenses, there are pinhole perforations in the metallic cameras, so arranged that a panoramic view of the complete circumference of the stomach is obtained at any level. This view is registered on small films, sixteen in all, eight upper and eight lower. The exposure is momentary and controlled, and the current is supplied by means of a special portable transformer giving a 12,000 candle power of blue light.

Before the tube with its enclosed camera is introduced into the stomach, the stomach is cleared of its contents as far as possible. The early morning, after a night's rest and at least ten hours of freedom from food ingestion, is an ideal time to perform this examination. Immediately before photographs are taken, the stomach is inflated by means of an air bulb attached to the tube. After a certain degree of inflation, the interior circumference of the stomach is sufficiently removed from the camera to enable the taking of proper exposures.

*The author was among the first in this country to resort to the use of the *gastrophotor*.—ED.

When the exposer button of the transformer is pressed, the photograph is taken. The entire procedure, once the tube is swallowed, requires less than a minute in the hands of an experienced operator. By this method it is possible to photograph the greater portion of the interior wall of the stomach, although in some instances more than one passage of the tube may be required.

There are times when an X-ray examination of the stomach will not reveal definite lesions, because of the hidden location of the diseased process, or because of the undeveloped or superficial nature of the lesion; it is then that this method of internal photography may serve a useful purpose. The records on the small films are easily enlarged so that a proper view is afforded. A physician who has had experience in the actual inspection of normal and diseased stomachs, in autopsies or at the operating table, should be able to make a correct interpretation of these photographic views.

Bougies and Tubes—Bougies, or "sounds," are occasionally passed into the gullet for the purpose of dilating or stretching a constricted area known as an esophageal stricture. These instruments are of various types, and are made of some plastic rubber compound or of whalebone shafts to which olive-shaped tips of hard rubber of different sizes may be attached. By the proper handling of this instrument, a stricture of either spastic (nervous) origin or organic character may be greatly reduced and the swallowing of foods may consequently be facilitated. Excellent results with this form of treatment have been frequently obtained. Naturally great care must be observed during the passage of a bougie. In recent years many improved forms of bougie or dilator have been devised for the special treatment of a variety of cases.

During the past fifty years or more, various types of stomach tubes have been devised for the study and treatment of many digestive disorders. These tubes are usually made of rubber, but in some instances the tips consist of metal and have holes or slots for aspiration or drainage purposes. The tubes also vary in caliber, some comparatively large with the circumference of a finger, others rather small with the caliber of a straw. Most of the tubes are marked off at certain levels, indicating the distance of the swallowed end of the tube from the teeth. The larger tubes, originally devised by Kussmaul, Boas, and Ewald, are usually employed for removing the contents of the stomach for study, but they may also be used for treatment, as in the so-called lavage or stomach wash. The smaller tubes, originally devised by Einhorn, Rehfuess, Lyon, Levin, and others, also may be used either for study or for treatment purposes. Some have a small metallic tip, but others are made

throughout of rubber. The advantage of the small-calibered tubes lies in the fact that they may be passed into the stomach, or even allowed to pass into the intestine, where they can remain for an extended period of time (hours or days). The larger tube is used ordinarily for only a short period (usually five to fifteen minutes).

Introducing the Tube—The passing of the tube into the stomach of a patient is not a difficult procedure, provided the physician has gained the confidence of the patient and convinced him of the value of this maneuver in the study or treatment of his case. It is not a too pleasant task for the patient, but with his co-operation the tube is easily swallowed and directed by the physician into the stomach.

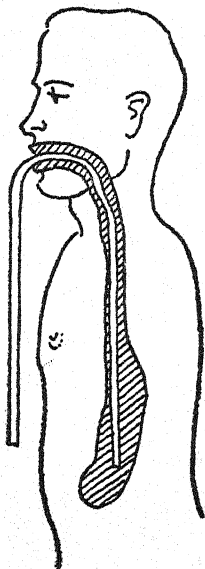
The technique usually involves: first, moistening the tip of the tube with cold water; second, placing the tip of the tube at the base of the tongue; and, third, instructing the patient to swallow regularly while the physician moves the tube onward with gentle pressure. The patient takes breaths of air at regular intervals and composes himself, and within a few seconds or minutes the tube will have entered the stomach. Most patients will retain the large tube within the stomach for many minutes with little or no difficulty, though nervous individuals may experience some discomfort in breathing or with reflex gagging.

The *Ewald tube* is the most frequently employed of the larger tubes for removing stomach contents or for washing the stomach. The contents are usually removed by attaching a large suction bulb which aspirates the contents from the stomach. In washing the stomach, a funnel instead of a suction bulb is attached; through this plain water or another solution is enabled to flow into the stomach until the stomach feels fairly well filled; then the funnel is turned toward a basin on the floor, and the fluid drains off. This filling and draining procedure is repeated a number of times until the returning fluid comes out clear; the stomach may then be regarded as having been cleansed satisfactorily.

The smaller tubes are introduced in the same manner as the larger tubes, but greater swallowing efforts on the part of the patient are usually required before the tip of a small tube reaches the stomach. Less pushing on the part of the physician is necessary, because of the softer, less resistant nature of the tube texture. In most cases this tube is quite agreeable to swallow. Some of the smaller calibrated tubes produced in recent years, although made of rubber throughout but slightly rigid, are administered through one of the nostrils back into the naso-pharynx (upper throat behind the nasal chambers); from here, with swallowing efforts on the part of the patient and with gentle

pressure by the physician, the tube reaches the stomach. Once the tube is in the stomach, the contents may be removed by aspiration through a syringe attached to the outside end of the tube, or allowed slowly to drain off into a basin placed at a lower level than the stomach itself. This tube may also be used for feeding patients.

If the patient retains the tube in the stomach for a considerable period of time, it may move onward as a result of the propulsive power of the stomach walls; this may cause the tube to pass through the pylorus (stomach outlet) into the duodenum (uppermost part of

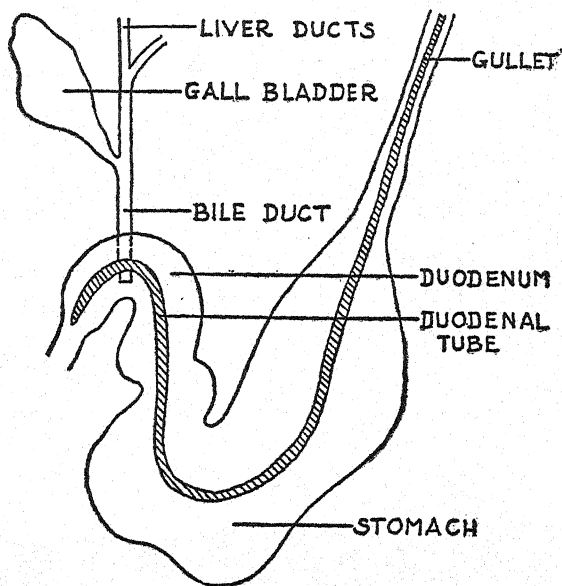


Showing the position of the stomach tube after it has been swallowed as far as the lower pole of the stomach.

small intestine). As a matter of fact, these tubes are usually marked off at certain levels: when the first mark reaches the teeth or the nose, depending upon the manner in which the tube has been inserted, the tube is in the body of the stomach; when the second mark arrives at the teeth or nose, the tube has reached the outlet or lowermost part of the stomach; the third mark in the same position indicates that the tube is well within the duodenum. These markings are essential in determining the origin of the contents removed; in the case of feed-

ing, they enable the physician to know into which part of the digestive tract food is being administered.

Through the use of these small tubes, an analysis of the contents of the stomach may be made at any given time after the taking of a test meal. Studies may be made one hour after the taking of this meal, at



Showing the position of the narrow duodenal tube as it extends downward through the gullet and stomach into the lower portion of the duodenum, where it is presumed to rest during "bile drainage." The proximity of the tube to the bile duct, which opens into the duodenum, is shown. The gall bladder and liver, through their respective small ducts, lead the bile into the main bile duct, which empties into the duodenum.

which time the contents are removed as completely as possible from the stomach. This is presumed by most authorities to be at the height of digestive activity. On the other hand, studies of samples of the contents may be made *fractionally*, every ten or fifteen minutes over a period of two or three hours; in this way the physician gains a comprehensive idea of the character of the entire digestive cycle. The contents are examined both for digestive power, which involves the chemical nature (acidity) of the secretion, and for ferment activity

(pepsin and rennin action). The presence of any food remains, and of abnormal tissue elements (blood, pus, bile salts, and so on) or material not normally found within the stomach during a test, is sought for.

A small tube that is allowed to enter the duodenum after a period of one to three or more hours is often spoken of as a *duodenal tube*; by this means the duodenal contents may be aspirated or allowed to drain off for study purposes, or food may be introduced directly into the duodenum.

It would be unwise in a work of this character to discuss in detail many other tubes and contrivances utilized in former years for the study or treatment of stomach and bowel disorders, since most of these instruments have little universal application. One other test to be mentioned, however, is the *diagnostic string test*, which consists in having the patient swallow a flat or rounded silk or cotton string, to which a small piece of metallic shot is attached, which works its way into the stomach and bowels. After a certain period of time (many hours), the string is pulled out through the mouth and closely examined for blood stains. The location of stains on the string and their distance from the teeth suggest the spot in the digestive tract where the bleeding occurs, usually in the stomach or duodenum.

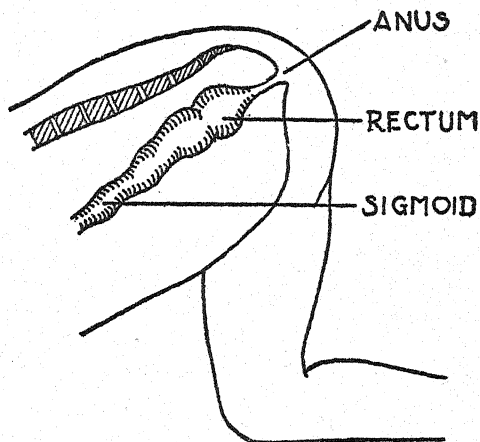
Proctoscopy and Sigmoidoscopy—A thorough investigation of the digestive system could hardly be regarded as complete without resort to an inspection of the anus (lowermost end of the bowel at its junction with the skin surface), the rectum (just inside the anus), and the sigmoid portion of the large bowel (just above the rectum). The findings frequently warrant the effort entailed by these examinations.

Before resorting to this instrumental examination, it is advisable to have the lower colon and rectum empty so that the wall of the intestine may be illuminated and inspected as thoroughly as possible. Fecal matter, excessive mucus, or any type of excrement in this portion of the bowel would, during an examination, hamper investigation. The usual procedure before performing a proctoscopy or sigmoidoscopy is to arrange for a cathartic the day before and a soapsuds enema on the morning of the examination (one or more hours beforehand).

The instrument consists of a long, hollow metal tube, about ten to fourteen inches in length and about one inch in diameter, with a small electrical illuminator either at the distal end, which is introduced, or at the proximal end, which, though not in the rectum, reflects light along the course of the hollow tube into the rectum. The former is the type of illumination most frequently employed in recent years. The

amount of current conveyed for illumination is controlled by a rheostat, and thus burning out of the small lamps does not occur readily.

Before the instrument is introduced, the patient is usually placed on a table in the knee-chest position. At this time the physician should, by a simple examination with the finger, ascertain if the rectum is clear and not obstructed by foreign material or by some diseased



Position of the patient during the course of a sigmoidoscopic examination. The instrument is inserted through the anus into the rectum and up into the sigmoid. These organs are then examined.

process of the rectum. Then the instrument, after being anointed with vaseline or some other lubricant, is introduced gently into the rectum for about two inches; under illumination and with great caution it is then further introduced as high as possible. The experienced physician will tilt the instrument so that it passes along the canal without meeting obstruction. Inspection through the bore of the tubed apparatus as it is being directed up into the bowel will facilitate its passage.

When the lower rectum is observed through this apparatus, the examination is spoken of as *proctoscopy*; when the instrument is introduced farther up, above the rectum, into the sigmoid portion of the bowel, the investigation is called *sigmoidoscopy*. The rectum and sigmoid region are examined while the instrument is being forced gently into the bowel and also as it is being withdrawn. The lining of the bowel is inspected as to color. Normally it is a pearly pink; abnormally

it may be reddish or bluish because of congestion or inflammation. The walls may be intact or eroded as in ulceration, or may present irregularities as in tumors or other lesions. Mucus may be present to excess as in catarrh of the bowel, and blood or pus may be seen, depending upon the type of diseased condition that exists. The extreme lower end of the rectum, or anus, is a common site of complaint and must be examined thoroughly, especially for hemorrhoids (piles), fissures (cracks), fistulas (canals), pruritus (itching), enlarged papillae and polyps (benign elevations of lining).

CHAPTER V

Analyses of the Various Digestive Secretions and Excreta

Saliva—The saliva of the mouth is the first secretion to be reckoned with in the digestive preparation of foods, but it is rather infrequently subjected to analysis as a routine measure. In some instances, however, a scientific investigator may feel inclined to determine the quantity secreted, its reaction, its ferment activity, and the presence of abnormal cellular elements. When the patient finds it difficult during the examination to produce a sufficient flow of saliva, this may be made easy by having him chew on some rubber or wax, following which the saliva (mouth juice) is collected. A few teaspoonfuls usually suffice for a proper study.

The fact that the secretion of saliva is increased in some conditions and decreased in others will be discussed in a later chapter. When a definitely recognizable disturbance in the amount secreted is evident, one must look to local diseases within the mouth and in the salivary glands for the most likely cause, and in more remote organs—such as the gullet, stomach, bowels, or brain—as a less probable origin.

Normally the saliva gives an *alkaline* or *neutral* reaction to litmus paper, but when this reaction is relatively reduced it is an indication that a tendency toward acidity exists. This may occur in diseases affecting the teeth and tonsils and possibly in some gouty states.

The ferment activity of the saliva is attributed to *ptyalin*, a diastatic ferment, which acts upon starches. On the basis of its effect upon these starches, a test is devised which appraises the activity of this ferment. The degree of starch digestion is recognized by the color of the reaction obtained while treating starch with a weak iodine solution. A defective diastatic (starch digestion) reaction may occur in cases of poor secretion of the salivary glands, in nervous conditions, or reflexly because of disorders within the stomach, bowels, or bile tract. Additional studies dealing with the cellular or constituent makeup of the

saliva may further enlighten the student as to the nature of the disturbances creating salivary secretory disorders.

Vomitus—Before proceeding to a discussion of the stomach contents, as obtained through the stomach tube by aspiration, it would seem logical first to consider material that may have been vomited. This vomited material (vomitus) may furnish the physician with valuable information if it is properly examined.

When an exceptionally large *quantity* of material has been vomited, there is a strong indication that it is due to an overcrowding or overfilling of the stomach, and if the material is mainly fluid in character it may consist of too much stomach secretion or an excessive amount of liquid which had accumulated in the stomach following excessive drinking. If, however, the material consists of considerable solid food, it will undoubtedly have resulted from the overeating of solids, or their accumulation over a period of time.

Certain abnormal conditions like *spasm of the stomach outlet* or *organic lesions* at this site may account for the retention of foods and secretions within the stomach. Such ailments as stomach catarrh (gastritis), weakness and stretching of the stomach wall (atony or dilation of the stomach), "dropped stomach" (gastroptosis), cancer of the stomach outlet, and adhesions around the outlet (pylorus) of the stomach may be the causative factors. When a large quantity of slime (mucus) is noted in the vomitus, such conditions as are characterized by the production of mucus in the stomach probably exist. This is a common finding in the disease known as *mucous gastritis*.

The *color* of the vomited material occasionally may have significance. Naturally the quantity and original color of the swallowed food has a bearing on the final appearance, but such outstanding coloration as yellow or green may indicate the presence of bile. Red or brown coloration may signify blood, and very dark brown or black vomitus usually points to blood which has undergone alteration or digestion. Vomitus having the appearance of "coffee grounds" usually implies the presence of blood, probably the result of bleeding within the stomach unless swallowed from above. Bleeding occurs frequently in cases of *ulcer* of the stomach or duodenum and in cases of bleeding *growths* (cancer or polyps).

Ordinarily, if the vomitus is examined chemically, it will be found to exhibit an acid character. A high degree of *acidity* indicates the existence of conditions likely to produce this reaction—for example, disorders of the stomach, ulcer of the stomach or duodenum, or reflex stomach irritability from other sources such as the gall bladder or

appendix. If the acidity is too low or virtually absent, other conditions which tend to produce this reaction probably exist, such as nervous disorders, gastritis, chronic forms of gall-bladder disease, a condition known as anacidity (absence of acid), achylia gastrica (stomach disease characterized by a depression of its secretion in quality and quantity), and cancer of the stomach. In rare cases of spasm or obstruction of the lower end of the gullet, vomiting may occur but the material ejected will, after analysis, reveal no acidity because the food comes from the lower gullet, not having reached the stomach where acid is secreted.

When the food has been retained in the stomach for many hours or days, the vomitus may have a foul *odor* due to fermentation or putrefaction of stale accumulated material. In rare cases, when the vomitus has a fecal (bowel excrement) odor, it usually indicates a regurgitation (backflow) of intestinal contents into the stomach.

As stated above, *blood* may indicate one of many conditions and will manifest itself in colors varying from light red to dark brown or black. The chief objective, then, is to ascertain the source of the bleeding and the nature of the ailment producing it.

When *pus* is found in the vomitus, it is the duty of the examiner to differentiate between swallowed pus from above (the bronchi and lungs) and pus from the gullet or stomach. Pus may result from severe infection of the stomach lining, or where an abscess from a neighboring organ has ruptured into the stomach.

When *bile* is found in the vomitus in great quantity, it may indicate disease within the liver or bile tract. This is not always the case, however, since in severe vomiting a backflow of bile may occur from some other cause.

At times *parasites* and *worms* or their eggs (*ova*) are vomited up; these serve as true evidence of conditions which need special medical attention.

Stomach Contents—The contents of the stomach are regarded from two viewpoints by the investigator: the *fasting contents*, which are found in the stomach after a fasting period; and the *test meal* or *test breakfast* contents, which are present in the stomach after the ingestion of a so-called test breakfast. As we have seen, either the large or small tube may be employed to aspirate the stomach contents. With the large tube, aspiration is accomplished through the use of a large rubber suction bulb attached to the outer end of the tube; with the small tube, aspiration is made through the use of a one- to three-ounce suction syringe, usually constructed of glass.

Fasting Stomach Contents—After the patient, according to instructions, has fasted for a period of at least twelve hours, the fasting stomach contents are aspirated. The patient has first been advised to have his main evening meal about five P.M. and then to eat only a small plate of boiled rice or barley at nine P.M. He has been told to eat or drink nothing after this, and to appear for the test at nine A.M. the next morning. The entire contents of the stomach are then withdrawn through the stomach tube and studied.

The *quantity* of material obtained from the fasting stomach may carry significance. Normally the amount of contents is believed to approximate 30 cubic centimeters (c.c.) or one ounce. Exceedingly large quantities point to an overproduction of stomach secretion, or to a retention of stomach contents beyond the normal length of time. The first, *overproduction of the secretion*, is probably due to stimulation of the nerves controlling secretion in one of several ways: either by psycho-neurotic factors, or by lesions such as ulcer and stomach catarrh, or reflexly from the gall bladder or appendix. The second, *retention of the stomach contents*, is probably due to interference with elimination from the stomach caused by an obstruction at the pylorus (stomach outlet), either of a spastic or of an organic nature—*spastic* when produced by nervous irritability of the pylorus (of psycho-neurotic or reflex origin), and *organic* when due to an organic involvement of this area as in ulcer, tumor, or adhesions. When no fluid is obtained from the fasting stomach it may suggest a *reduced secretion* of stomach juice, or an *increase in the motor activity* of the stomach in consequence of which emptying is hastened.

The significance of the *color* of the specimen obtained may be said to correspond identically with what has been said above regarding the colorization of the vomitus. One exception, however, may be noted regarding the green or yellowish tinge of fasting contents, since this is not necessarily due to the presence of bile, but rather, on occasions, the result of a chemical process connected with the presence of organisms of the mold type or with the presence of organisms which contain a substance known as chlorophyll. The significance of red, brown, and tar colors and an appearance resembling coffee grounds have been discussed under the subject of Vomitus above.

A watery *consistency* indicates the predominance of either retained fluid foods or the more watery elements of the stomach secretion. When the consistency is thick or viscid, the proportion of mucus must be large. If the mucus has not been swallowed from above, it is probably a product of the mucus-secreting glands of the stomach wall. The

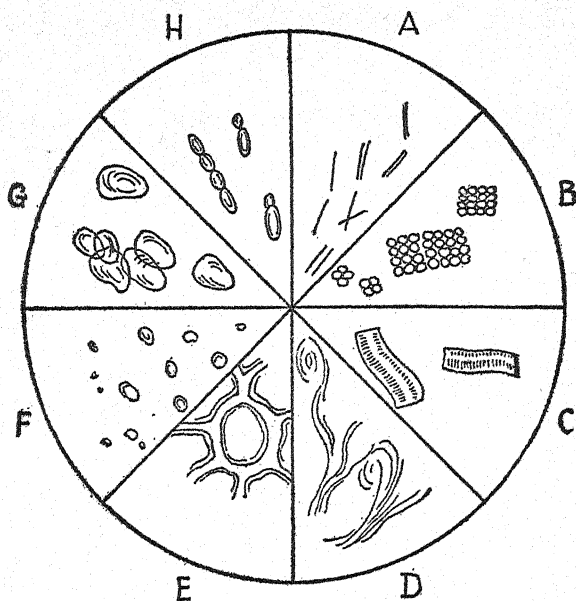
latter element is found increased in cases of catarrh of the stomach and cancer.

The *chemical reaction* of the stomach contents is usually acid in normal as well as in diseased conditions, but in rare cases where no acid is being secreted and where excessive mucus has accumulated the reaction may at times be neutral or alkaline. Also, in regurgitation from the duodenum (upper intestine), as a result of a nervous disturbance or disease factors, the presence of intestinal material in the stomach may give its contents an alkaline reaction.

The *odor* of the material obtained from the fasting stomach will vary, depending upon the nature of the aromatic substances it contains. Often it is practically odorless or slightly sour. When strong fermentation or putrefaction has occurred, the odor becomes offensive. When the odor suggests that of rancid butter, it is probably produced by butyric acid (a product of fat fermentation); when it suggests vinegar, it is probably due to acetic acid (a product of acetous fermentation); when it simulates rotten eggs, it is due to hydrogen sulphide gas (a product of protein or animal tissue putrefaction).

Often, as in the case of the vomitus discussed above, the fasting stomach contents contain recognizable ingredients such as *food remains* eaten the day before; thick *slime* (mucus) probably the result of irritation of the stomach lining; *pus*, which has either been swallowed from above (from the nose, throat, or bronchial tubes) or which exudes from the lining of the gullet or stomach due to disease (ulcer, cancer, or abscess); *blood*, the result of bleeding; *bile*, when a considerable reflux has occurred from the duodenum; and *worms*, which are rarely found.

Finally, a very important study which may reveal valuable information regarding the condition of the stomach is made through the *microscopic examination* of the fasting contents. Normally only such elements as are thrown off by the intact healthy stomach-wall membrane, together with the swallowed saliva and sputum, are found and appear as *leucocytes*, *epithelial cells*, *small plugs or strands of mucus*, and so on; but when such elements as *mucus*, *red blood cells*, *leucocytes*, *parasites*, and *food particles* are found in definitely excessive proportions, some abnormality is suspected. A large amount of mucus or slime implies an irritation of the stomach lining; a large quantity of red blood cells indicates bleeding; an excessive amount of white blood cells suggests pus. A large quantity of food particles spells retention or failure of the stomach to eliminate in proper time. This



Microscopic view of the fasting stomach contents.

- A—Opler-Boas bacilli, lactic-acid-producing organisms causing fermentation. Found in cancer near or at the stomach outlet.
- B—Sarcinae, organisms concerned with fermentation. Found in benign growths at or near the stomach outlet.
- C—Muscle fibers, indicating the retention of meat remnants in the stomach.
- D—Mucus strands which in excess suggest stomach catarrh.
- E—Cellulose or vegetable framework of food previously eaten.
- F—White cells and red blood cells, occasionally present in the fasting stomach, the result of catarrh or slight hemorrhage.
- G—Starch cells, the remains of food (as bread or potatoes) previously eaten.
- H—Yeast cells, presumably due to fermentation within the stomach.

may be due to an obstruction at the stomach outlet (pylorus) or to a loss of stomach tone (atony) which hampers stomach emptying. Under the microscope these food particles are seen as muscle fibers, starch cells, fat droplets or fatty acid crystals, vegetable cells of varying forms and their framework (cellulose), and general detritus or debris. At times it may be necessary to stain the cells with iodine to recognize

their starch content, and with sudan or osmic acid to confirm the presence of fat.

Many *parasites* and *small organisms* also may be seen in those cases where the food has stagnated in the stomach for a fairly long period of time. *Yeast cells* indicate carbohydrate fermentation, as do *sarcinae*, another type of vegetable organism. An organism similar to the *lactic acid bacillus* so much advertised by Metchnikoff, but believed not to be exactly the same organism, is occasionally found and is known as the *Opler-Boas bacillus*. It is associated with lactic acid fermentation. The presence of these organisms, of course, implies the existence of food retention in the stomach far beyond the normal time limit.

At times crystals of *fatty acids*, *leucin*, and *tyrosin* are found in the contents when fermentation or putrefaction has occurred, and *bile acids* and *cholesterin* crystals may be seen when the bile has regurgitated into the stomach and settled there for a time.

Occasionally it is possible to note shreds of *lining tissue* (mucosa) which have separated from the stomach wall and may appear either as normal, ulcerative, or tumor tissue, thus giving a clue as to the presence of disease. Rarely small unicellular or other organisms such as the *amoebae* and *flagellatae* are seen; these often indicate the nature of the ailment and frequently are associated with malignant disease of the stomach.

Test Meal or Ewald Test Breakfast—The test breakfast consists of two medium-sized slices (about one ounce) of bread or toast and about eight ounces of water or tea. This is taken on an empty stomach, preferably in the morning. After this food has been in the stomach for an hour, at which time the maximum power of digestion is ordinarily attained, the contents of the stomach are aspirated and examined. After proper analysis, reliable data pertaining to the chemical and digestive nature of the stomach secretion are acquired.

A *small quantity* of contents may indicate a poor elaboration of secretion by the stomach wall or an exaggeratedly speedy emptying of the stomach. A *large quantity* of contents may point to hypersecretion (overaction of the secreting stomach wall) or a prolonged retention of the contents of the stomach beyond the normal time limit. Experience has shown that about two and one-half to four ounces of stomach contents are normally obtained; therefore quantities of greater or lesser degree must be carefully interpreted.

The nature of the contents must also be scrutinized. An *excessive quantity of fluid* material usually points to hypersecretion. An *excess of mucus*, of course, would imply excessive mucus secretion. An *excess*

in solid constituents (bread) would denote an interference with the emptying of the starch contents. The bread is usually finely divided and mushy when digestion is good, but poorly divided, coarse, and clumplike when digestion is poor. The former appearance probably results from a proper digestion of the gluten or framework surrounding the starch cells, whereas in the latter instance this framework is poorly digested, thus hampering the starch cells from a thorough penetrative digestion.

Ordinarily the contents, upon standing, reveal two layers: a *lower solid* or bread-pap sediment, and an *upper fluid* layer. But in cases of food retention (due to obstruction) over a lengthy period of time, three layers may be noted: first, a *lower solid* layer of food particles; second, a *middle cloudy layer* of fluid; and, third, an *upper foamy* or gaseous layer, the result of fermentation.

The *odor* of the test breakfast contents is usually musty and occasionally sour. When abnormalities which prevent proper elimination of the stomach contents exist, a retention may alter the odor definitely, so that a rancid butter (butyric acid) odor, a rotten egg (hydrogen sulphide) odor, or some other fetid odor will manifest itself. When regurgitation of intestinal material from the bowel into the stomach takes place, the odor will assume some of the aromatic characteristics of the intestinal contents. In cases of cancer of the stomach, when tissue destruction occurs, a foul odor resulting from albuminous tissue degeneration will follow.

Acidity—The most important information regarding digestive power is gleaned from data on the *degree of acidity* and *ferment activity* obtained by examining the test breakfast contents. Since it is assumed that the chief stomach ferments—pepsin and rennin—act only in an acid medium, the index of digestive power is readily deduced from the acidity of the contents. We therefore analyze the contents for the amount of *free hydrochloric acid*, *combined hydrochloric acid*, and *total hydrochloric acid*. The *free hydrochloric acid* is the quantity of acid which exists uncombined and free after secretion by the cells of the stomach; the *combined acid* is the amount which has chemically attached itself to the protein foods or substances in the stomach, and the *total acid* is the sum total of the aforementioned types of hydrochloric acid and becomes the chief index of digestive power.

From experience it is believed that the *normal range* of total acidity varies from 45 to 65 degrees per cent, while the free acidity varies from 20 to 50 degrees per cent. These results, however, must be correlated

by the examiner with the total amount of the contents he finds in the stomach before he may properly adjudge its significance.

A *high degree of acidity* may be due to over-secretion, or to the elaboration of a highly concentrated juice, or to an over-concentration of the stomach contents because of a retardation of the emptying time. Various disorders either functional or organic in nature may account for a high degree of acidity. Ulcer of the stomach or duodenum, nervous disturbances of the stomach, and reflex disorders such as result from appendicitis, gall-bladder disease, or genito-urinary affections are common examples.

A *low degree of acidity* may result from poor qualitative or quantitative secretion by the stomach glands, or because of dilution of the stomach juice by the retained fluid foods. Occasionally it may result from a regurgitation of the alkaline intestinal contents into the stomach, as a result of which the acidity of the stomach contents is reduced. When the total acidity is not more than ten degrees per cent and the free acidity is negative (not present), the condition is very likely due to a disorder in the stomach secreting mechanism; this is spoken of as *anacidity*. If ferments are absent or decidedly reduced, the condition is called *achylia gastrica*. In some cases of cancer or chronic gastritis (catarrh of the stomach) this finding may present itself. A reduced acidity is frequently found in various forms of gastritis, in certain depressive nervous states, as a reflex disturbance in gall-bladder and liver disorders, in certain blood diseases, and in pancreatic ailments.

Occasionally in instances of food retention within the stomach over a long period (days and weeks) some organic acids of relatively small quantity may be found. The chief among these is *lactic acid*, produced by fermentation of foods held in the stomach. An obstruction at the stomach outlet (pylorus), of either a benign or a malignant nature, may be the cause.

Ferment Activity—The two chief ferments in the stomach contents, *pepsin* and *rennin*, may be appraised as to their degree of activity by various tests. The Hammerschlag or Metz methods are utilized for the examination of the former and the Boas method for the latter. Various modifications have been devised in recent years by other authorities, but in this volume we shall merely consider these older methods.

These tests are ordinarily performed in cases where the stomach contents exhibit either an absence of free hydrochloric acid or a rather low total acidity, because it is in these instances that a diminution of the ferments is expected. The Hammerschlag or Metz tests are concerned with the estimation of the degree of *digestion of albumen*

(egg white) which denotes pepsin activity; the Boas test is concerned with the determination of the degree of *coagulation of milk* by various dilutions of stomach contents, and denotes rennin activity.

A deficiency of ferment activity may indicate a depression in the secretion of the stomach ferments brought about through the medium of the nervous system as in cases of hysteria and neurasthenia, or through an organic disturbance involving the secreting portions of the stomach walls as in achylia gastrica or cancer of the stomach.

Fractional Analysis of the Stomach Contents—By this method, after the small tube has been swallowed into the stomach, samples of the stomach contents (each about five c.c.) are withdrawn every fifteen minutes over a period of two hours or more. Of course it is understood that physicians experienced in this procedure are best qualified to do this work and will more intelligently interpret their findings. Many authorities, chiefly Rehfuß, who have supported it believe that by this mode of investigation a more comprehensive understanding of gastric (stomach) digestion is attained. They conclude that gastric digestion is divided into a series of recurring cycles, namely, the *digestive* and *inter-digestive* cycles, the former responding to the ingestion of food, the latter to the period of stomach rest (relatively inactive secreting period).

From observations made upon a large number of normal persons, it is believed that there are three types of normal digestive curves, designated as *hyper-*, *hypo-*, and *iso-secretory curves*. When an abnormal condition exists, it is assumed that the curves will exhibit such variation or modification as might be attributed to this. Investigation of the abnormal curves of gastric secretion will indicate the presence of depressions or exaggerations of the phases of secretion, instead of the perfect evolution of digestion which is considered symbolic of normal cases. Such manifestations may be characterized by (1) either a delay or an acceleration in digestion; (2) a disturbance in the quantity of material secreted; (3) a disturbance in the quality (acidity) of the secretion; and (4) a modification of the stomach secretion through the addition of definite quantities of mucus, blood, pus, or other foreign elements, including material regurgitated from the intestines. An intelligent interpretation by an experienced student of fractional analysis should aid considerably in a reliable diagnosis of digestive disorders.

Duodenal Contents—In order to obtain duodenal contents for study, the small tube is swallowed by the patient, who has fasted overnight or for a period covering twelve to fifteen hours. When the "2"

mark on the tube reaches the lips, it is assumed that the tip of the tube is in the lowermost pole of the stomach near the outlet. A glass of water is then given to the patient for the purpose of stimulating the motor activity of the stomach; he is advised to lie on a couch on his right side, and to swallow the tube slowly from the "2" mark to the "3" mark, taking at least fifteen to twenty minutes for this procedure. When the tube has been swallowed to the point where the "3" mark has reached the lips, the tip or distal end of the tube will ordinarily have passed through the stomach outlet into the duodenum (uppermost small intestine) down to the level at which the bile duct enters this organ. The outside or proximal end of the tube leads from the mouth into a basin or jar situated on a low stool or on the floor near the couch. The material from the duodenum will then gravitate slowly by drainage into this receptacle. An experienced physician or attendant who has made a thorough study of this subject and its technical demands can readily determine when the tube is in the duodenum and out of the stomach.

The material usually obtained from the duodenum is either *pearly gray* or slightly bile-stained and mucoid (viscid) in character. The *amount* varies from one teaspoonful to an ounce or more. It is *alkaline* in reaction in contradistinction to the stomach secretion, which is acid in reaction. In abnormal conditions the gross appearance of the material may be different. Under the microscope the contents will normally show a few *lining-tissue cells* which have been shed by the wall of the duodenum, some small *flakes of mucus*, and few scattered *bacteria*.

In abnormal situations increased quantities of *shed tissue cells* may be found, and large numbers of *white blood cells* (leucocytes), *red blood cells*, and *bile crystals* are often seen. From the findings correct diagnoses are frequently made, but for further enlightenment on the possibility of diseased conditions, especially those involving the liver and bile tract, duodenal drainage or bile drainage is resorted to.

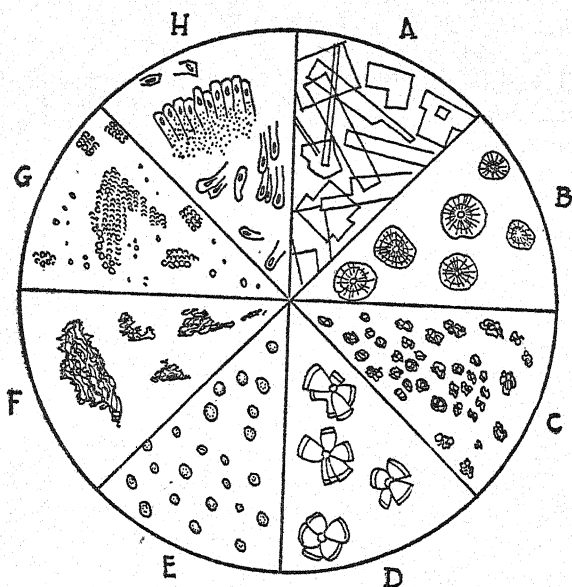
Bile Drainage—After the material of the fasting duodenum just discussed has been removed by aspiration (suction) and drainage, the duodenum is gently douched with two to three ounces of 25 per cent Epsom salt solution or 10 per cent peptone solution. Some physicians use plain olive oil or a solution of sodium phosphate instead. This is then allowed to siphon off into a basin or receptacle placed at a lower level than the patient's head. Lyon was the outstanding authority who gave strong impetus to the practical application of this method. It was Meltzer primarily who demonstrated on dogs that, after the introduction of the Epsom salt solution into the duodenum, a general relax-

ation of the entire wall of the duodenum occurs. As a result of this relaxation the small circular band of musculature known as Oddi's sphincter, which surrounds the common bile duct at its junction with the duodenum, is also relaxed. With this relaxation of the sphincter muscle of Oddi, the bile duct is opened and bile flows into the duodenum. Thus a flow of bile is established; this continues for an hour or more during the test period, and is often referred to as bile drainage.

Three distinct types of bile are assumed normally to drain off. First, the *A bile*, which is of a light yellow color, begins to flow immediately after the magnesium sulfate (Epsom salt) solution has been introduced; this presumably comes from the common bile duct. Second, as drainage continues, the bile becomes darker, a golden yellow, and more syrupy and at this stage is known as the *B bile*; it is presumed to consist chiefly of bile that had been located in the gall bladder. Finally, as the flow continues, the bile again becomes light in color and less syrupy, now presumably issuing from the liver and known as the *C bile*. The period of time for the expression of the A bile takes from five to fifteen minutes, for the B bile from fifteen to thirty minutes, and for the C bile from fifteen minutes to an indefinite length of time to the completion of the study.

Normally under the microscope the three specimens or fractions of bile, A, B, and C, show a few *tissue cells* shed from the walls of the bile ducts or duodenum, a few *strands of mucus*, and occasionally a few *bile crystals* and *bacteria*. When the microscopic view affords evidence of increased amounts of mucus, bile-stained tissue cells, *pus cells*, and bile salts and crystals, the likelihood of a diseased condition becomes more apparent. Students of this subject will aim at associating the findings with the other qualities of the particular specimen examined, A, B, or C, and will make interpretations accordingly. Abnormal findings in the A bile may suggest disease in either the duodenum or the common bile duct, in the B bile may point to gall-bladder disease, and in the C bile to liver diseases; when the abnormality is found in more than one fraction, the experienced observer may assume that the disease involves more than just one portion of the bile tract.

The question of the *depth of bile staining* to which some of these elements have been subjected also carries significance. The lining cells which are shed from the various walls—such as duodenal cells, common duct cells, smaller bile-duct cells, gall-bladder wall cells, and liver cells—may all give a clue as to the existing disorder. Whether they are shed *singly* or exfoliated in *strips* or *sheaths* may have significance. Cells from the various sections have a distinctive appearance. In infec-



Microscopic view of bile drainage material.

- A—Cholesterin crystals, a form of bile salt.
- B—Lencin crystals.
- C—Tissue cells from the lining of the duodenum, found in catarrh of the upper small intestine.
- D—Splintered lencin crystals.
- E—Isolated pus cells found in infections of the gall tract.
- F—Bunch-berry crystals of calcium bilirubinate, found in the bile in some cases of gall stones.
- G—Short columnar epithelium, or shreds of lining which originate from the gall ducts.
- H—Tall columnar epithelium, or shreds of lining which originate from the gall bladder.

tions large numbers of *pus cells* and *bacteria* will be seen under microscopic examination.

A considerable amount of bile-stained sediment in any of the bile fractions may indicate disease of some portion of the bile tract, and a thorough study of the material under the microscope should give a clue as to which part of the tract is definitely affected. Deep-stained mucus and pus indicate catarrh and infection respectively.

Study of the type of crystalline material present in the sediment is also important and often helpful in making a diagnosis of gall stones. *Cholesterol crystals* are thin, colorless, transparent, and of rhomboid or parallelogram form. Some are nicked at one corner and resemble the map of Pennsylvania in appearance. They may be found singly or in groups. They are believed to result from stasis of bile or sluggishness of the bile flow. When they are present in large numbers or clumps, conditions favoring the presence of gallstones exist. Various *calcium crystals*, usually thick, colorless, and pointed or triangular in form, when noted under the microscope and in quantity suggest a tendency to sand or stone formation. *Calcium bilirubinate* may occur in forms that are crystalline, or amorphous (without specific shape), or bunchberry (like a bunch of berries in appearance). They vary in color from light yellow to orange. In small quantities they suggest stasis within the bile tract or a tendency to stone formation. In large quantities they may indicate the presence of sand or stones in the gall tract.

When a large number of crystals are noted, the question of bile stasis or an inclination to stone formation may be a proper assumption. A physician well experienced in this work may, with a great sense of security, arrive at definite conclusions as to the diagnosis and proper treatment of affections involving the liver and bile tract.

Pancreatic Ferments—Specimens of material obtained from the fasting duodenum or from the bile fractions may also furnish information as to the integrity of the pancreatic ferments. These ferments are known as *trypsin*, *amylase*, and *steapsin* or *lipase*. They act on various foods in the intestinal tract. The trypsin acts on proteins or meats, the amylase on carbohydrates or starches, and the steapsin or lipase on fats.

A number of tests have been devised for the appraisal of the activity of these ferments. Trypsin activity is determined by studying its digestant effect upon a 5 per cent gelatin solution; amylase function is appraised by the study of its effect upon a starch solution; and steapsin or lipase activity is estimated by its digestant effect upon a simple fatty substance.

Liver Function Tests—Unfortunately it is difficult to recognize mild disturbances of liver function, because the patient seldom at this stage of the ailment gives subjectively or objectively sufficient evidence of any disorder. In recent years, however, some advances have been made in the recognition of early liver disturbance by study of the absorption and elimination of a dye known as phenol-tetrachlor-phthalein. This drug is absorbed and eliminated by the liver through the bile. Some authorities (Rountree, Horowitz, and Bloomfield) studied the amount

of dye excreted in the feces over a given period of time and from this endeavored to discover an index of liver function. Others injected the dye intravenously and then, through a duodenal tube which had previously been passed into the duodenum (upper small intestine), collected the bile which then contained the dye as eliminated by the liver through the bile. Estimates were made as to the time when the dye *first appeared*, the *color intensity*, and the *quantity* eliminated within two hours or more, and from them conclusions were drawn as to liver function.

Rosenthal injected the dye intravenously in one arm, then later removed samples of blood from the other arm and compared the amount of dye present with certain standards. In normal cases the dye had disappeared from the blood within forty to sixty minutes. In disease it remained in the blood for from one to five hours or more.

An interesting and rather widely used test for the determination of liver function is known as the *bromsulphalein test*. The dye bromsulphalein, in proper quantity according to body weight, is given to the patient by injection into a vein in the arm. After its dissemination throughout the blood stream, it is quite readily removed from the circulation by the cells of the liver as the dye-laden blood reaches these tissues. At intervals, shortly after injection, small samples of blood are removed from the other arm and colorimetric readings are made in a Dunning colorimeter; information is thus obtained as to the amount of dye retained in the blood. The dye retention indicates the degree of deficiency in liver function.

A simple test for liver function is known as the *levulose test*, which consists of giving two ounces of levulose to a patient who had fasted at least ten to twelve hours. After a certain period of time during which water is drunk, the urine is examined for sugar. In a normal person there will be no positive sugar reaction in the urine, but in individuals with liver disturbance sugar will be found in the urine.

A similar test for liver function is known as the *galactose tolerance test*, which consists of giving the fasting patient 40 grams ($1\frac{1}{2}$ oz.) of galactose. Likewise, the patient is given plenty of water to drink, and the urine is examined for sugar at certain periods; from the amounts of sugar found conclusions as to liver integrity are formed.

Another simple test which may reveal a liver disorder is the so-called *Ehrlich urobilinogen test*, which consists of adding a small quantity, usually one cubic centimeter (1 c.c.), of Ehrlich's aldehyde reagent to a test tube of urine. A red color develops, the intensity of which is dependent upon the concentration of *urobilinogen* in the specimen. A

light red color is normal. Wallace and Diamond have improved this test so that, instead of it being a qualitative test for the determination of the presence of urobilinogen, it also becomes a quantitative test and an idea as to the amount of urobilinogen in the specimen is attained by noting the rapidity and intensity of the color development. Dilutions of the urine are tested and the highest dilutions that show a faint pink color express the result. The color, if obtained in dilutions above one to twenty, is regarded as abnormal. Excessive amounts of urobilinogen in the urine will point to a liver disorder, but the true nature of the disease or condition that produces the liver disturbance must be determined by the physician through further study.

Another important test is the *icterus index*, which is a quantitative estimate of the amount of *bilirubin* (bile pigment) in the blood serum; this indicates the quantity of latent (not apparent) jaundice, and indirectly aids in the making of a diagnosis, especially in regard to liver function. It consists in matching the blood serum in a colorimeter against a known standard of a 1 to 10,000 potassium bichromate solution. The index of bilirubin concentration is obtained. Normally the index is between 4 and 5; the zone of latent jaundice is between 7 and 15, and that of obvious and unmistakable jaundice is above 15.

Another outstanding test is the *Vanden Bergh test*. This also detects bilirubin in the blood stream by means of Ehrlich's reagent, but has as its chief objective the recognition of two types of jaundice and the demonstration of the type which exists in the case in question. The so-called indirect method indicates the existence of jaundice, either of the obstructive or non-obstructive type, but the direct method expresses a quick reaction significant of obstructive jaundice.

Feces (Bowel Excrement)—The feces, often referred to as the *stool*, consist of material that has been eliminated by the bowel after the food has passed completely through the digestive canal. They are regarded as made up of food remains (indigestible food or food elements that have escaped absorption), digestive secretions from almost any part of the digestive tract which have not been absorbed or destroyed, various mineral salts, cellular elements which have been shed from the walls of the gullet, stomach, bowels, and bile tract have survived digestion, and the bacterial flora (vegetal organisms) of the bowel tract.

The *quantity of the feces* (stool) excreted daily will vary, depending upon the quality and quantity of food eaten and upon the individual characteristics of the digestive system. Where large amounts of food are eaten, especially if the food consists of a great proportion of indi-

gestible material (as in a vegetable diet), the amount of fecal residue (waste matter) should be large. In instances where the food is rushed through the stomach and bowels without thorough absorption, a large amount of waste may occur. Also in cases of constipation, where the food becomes stagnant within the large bowel, the quantity of excrement may be large at the time of movement but the bowels may not move daily. The average daily amount is three to four ounces.

The *average number of stools* (bowel movements or evacuations) voided daily by a normal person is one or two. At times there are more than two in apparently healthy individuals. When diarrhea (looseness of the bowels) occurs, the number of movements is usually greatly increased. When constipation occurs, the bowel movements are usually reduced in number and in rare instances may not occur for days. Many people have uniformly regular bowel movements almost to the exact hour daily, whereas others apparently enjoy no such regularity. Normally the remains of food eaten will have been evacuated from the bowel within 24 to 48 hours; retention beyond this period may signify disorder.

The *odor of the stool* ordinarily is attributed largely to a substance known as skatol and in a lesser degree to indol. They are both products of putrefaction (albuminous decomposition). The intensity of the odor depends upon the character of the diet. It is more marked in the excrement of meat eaters than in that of vegetable eaters. When large amounts of meat are eaten and not fully digested, the protein remains undergo putrefaction and a peculiarly offensive odor results, probably due to the presence of larger amounts of skatol and indol as well as phenol, ammonia, and hydrogen sulphide gas (other putrefactive products). The last substance mentioned produces the odor of rotten eggs. In carbohydrate or fat decomposition the stool will emit a sour odor, due to such fermentative products as volatile fatty acids, lactic acid, acetic acid, and succinic acid. Where fatty stools are passed, a rancid-butter odor due to butyric acid may be noted. In instances of organic disease of the liver, stomach, pancreas, or bowels, with pronounced destruction of tissue, albuminous putrefaction may occur; this will be due to the decomposition of the tissues themselves, in addition to the profound constipation which may accompany the condition. In amoebic dysentery the odor may be that of glue, probably because of the excessive production of secretions, particularly mucus. In some cases characterized by a rushing of the intestinal contents through the bowels, the odor may be negligible because of the absence of bacterial fermentation caused by the rapid elimination.

The *consistency of the stool* varies in individual cases and in the same person from time to time, depending upon the nature of the food eaten. In most cases it is normally of cylindrical form and doughy or soft. At times, when the feces have been retained in the colon and rectum for a longer period than normal, resorption of fluid occurs and the stool assumes a more brittle and rather firm quality, tending to break into small hard masses, called *scybalæ*, which may be square, round, or fusiform (like spindles) in shape. This is found in cases of constipation due to *atony* (weak muscle tone). In constipation due to *spasticity* (increased muscle tone) the stool is firm, of smaller caliber, and of pencil or finger width. In some cases of rectal stricture, obstruction of the rectum, spasm of the anus, and prolapsus ani (relaxation of the anus), the stool has a much reduced caliber or may be flattened like a ribbon. In bowel catarrh or enteritis and in diarrheas, the stool may be more or less fluid or semi-solid. Where large quantities of mucus are eliminated, the condition spoken of as mucous colitis may be present. In this disorder large casts or lumps of mucus are often passed.

The *color of the feces* is normally dark brown, due particularly to the presence of hydrobilirubin or urobilin (bile which has been altered chemically by the intestinal bacteria). The type of food which predominates in the diet may also contribute in a degree to the coloration. A mixed diet may cause the stools to vary from light to dark brown; an increased meat diet will bring about a brownish-black stool; and milk, dairy, and starchy foods contribute toward a light-colored stool. Dark fruits like grapes, plums, and berries produce dark-colored stools.

Green or greenish-tinged excrement suggests a rapid elimination from the large bowel, because the bile which originally entered the upper small intestine has not undergone alteration at the instigation of the bacteria of the large intestine.

A clay-colored or very light stool is usually due to a pronounced deficiency or total absence of bile content. As a result the fats in the stool are not acted upon, and this also contributes to a light coloration. Bile in such instances may have been poorly secreted by the liver, or the flow into the intestine may have been obstructed. In the former it may be due to liver diseases such as cancer or cirrhosis, anemias, or poisoning, whereas in the latter it may result from gall-duct stones, cancer, catarrh, or any inflammation which creates an obstruction to the bile-tract outflow. A fatty, light-colored stool is commonly found in pancreatic diseases, and this also holds for intestinal tuberculosis.

A red, through chocolate, to tarry-colored stool is found in cases of

bleeding within the digestive system. Bleeding low in the digestive tract—not far from the anus or bowel outlet—may produce a red color; if it comes from a source higher up, as from the stomach, duodenum, or bile tract, the color is much darker. In some instances blood in small amounts causes no color changes and its presence is detected only by a chemical test (occult blood test).

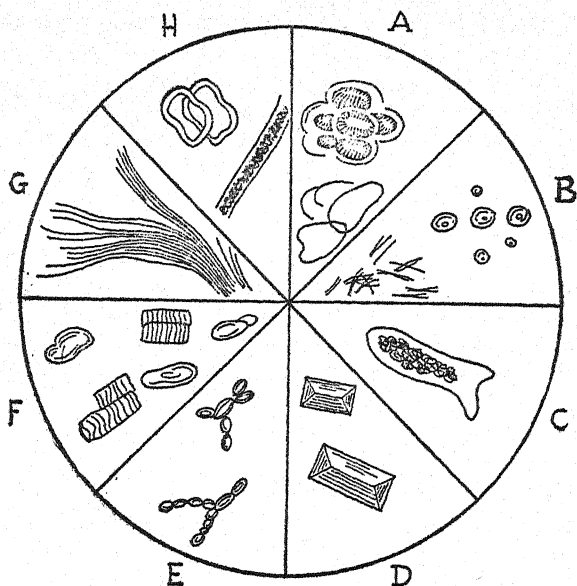
Test Diet—In special instances it may be necessary to assert control over the output of fecal matter, so as to appraise the integrity of digestion with respect to certain specific food elements. To bring this about, it would seem essential to make sure that the remains of food eaten before and after the test meal will be distinguished in the excrement. This is accomplished by giving the patient a dye to ingest which will color the stool. The dyes used are charcoal and carmine, which color the stool black and red respectively. The uncolored fecal matter eliminated between the taking of the dyes may be regarded as the residue resulting from the test diet.

One of the simplest diets advocated for this purpose is the modified Schmidt diet, which consists of a specified amount of oatmeal or other cereal, toast, butter, and milk for breakfast; chicken rice soup, green vegetables, mashed potatoes, toast, butter, and milk for luncheon; and chopped meat, green vegetables, mashed potatoes, toast, butter, milk, and stewed fruits for dinner. This diet is indulged in for three days or longer; its residue is distinguished from other food remains by the dye control method mentioned above, and should furnish evidence as to the digestive disorder which exists.

Anyone acquainted with the physical appearance of fecal matter will readily distinguish between a normal or abnormal stool. Normally after this test diet the stool appears as a homogenous specimen, consisting of small pinhead-sized debris, except for occasional chaffy oatmeal remains or occasional fruit sand or seeds and vegetable framework.

When diseased conditions have been present during digestion, such other residue as tendon and connective tissues (framework of meats), undigested muscle tissue (body of meat), starch framework, undigested starch cells, fat, mucus (slime), pus, blood, large crystals, fragments of tapeworms, worms, or sand may be found; their value will be properly interpreted by the investigating physician.

Before making final conclusions regarding the food remains seen grossly in a stool specimen, however, the investigator should recheck by microscopic study. This is very easily done by the observer; the technique involves study of specimens of diluted stool, either unstained or stained by specific dyes.



Microscopic view of the contents of the feces (stool).

- A—Starch cells, the remains of such food as potatoes and bread.
 - B—The rounded globules indicate neutral fat. The pointed needles indicate fatty acid crystals. The remains of fat foods.
 - C—Amoeba, parasite occasionally seen in cases of amoebic dysentery infection.
 - D—Triple phosphate crystals.
 - E—Yeast cells; sprouting indicates fermentation.
 - F—Muscle fibers, both striped and unstriped, the latter partially digested.
 - G—Fibrous tissues or the connecting structure of meat remains.
 - H—Cellulose or vegetable framework in various forms.
- Wheat remains.

Normally the microscopic view will present a homogenous mass of detritus (remains), consisting of granular debris and bacteria, some occasionally larger bodies such as partly digested muscle fibers, isolated digested starch cells, chaffy oatmeal remains, lime salt crystals, and colorless soap remains.

Abnormally the microscopic view will show, in addition to the mass of homogenous detritus, connective tissue remains (meat framework), muscle remains (body of meat), carbohydrate remains (starch cells

and starch framework), fat remains (either as neutral fat, crystals of fatty acid, or soap needles), mucus in large quantities, yeast cells, pus, blood, or parasites or their eggs (ova). These all have specific significance and furnish clues as to the type of existent digestive disorder.

The *occult blood test* of the stool is a chemical test to which the fecal excrement is subjected when no blood is seen in the stool but its presence is nevertheless suspected. The test should be made upon a specimen of fecal residue obtained after the patient has been on a meat-free, green-vegetable-free, and iron-free diet for a number of days. The tests are known as the benzidine and guaiac tests. The former, being more delicate, is more reliable. The presence of blood in the stool usually indicates bleeding in some portion of the digestive system unless blood has been swallowed from other sources, as from the nose, bronchi, and lungs.

A *bile test* of the stool is often made to determine the presence or absence of altered bile (urobilin or urobilinogen). Urobilin is normally present. A test for this substance (the Schmidt test), made by adding bichlorid of mercury solution to some of the excrement, produces a red or pink color if altered bile is present. If unaltered bile is present the test produces a green color. When no bile is present, no color changes occur. The experienced examiner will immediately recognize the value of these test results and draw inferences as to the cause of the abnormal findings.

Ferment Studies of the Stool—In certain cases, where improper digestion of food is evident by the gross and microscopic findings in the fecal excrement, it may be the desire of the physician to ascertain the degree of defection in ferment activity without forcing an already debilitated patient to swallow a tube. This is accomplished by subjecting the ferments within the excrement to appraisal.

By the *Wohlgemuth method*, or a modification of it, the secretions of the digestive tract which have been incorporated in the stool are studied for so-called diastatic activity (starch digestion). The stool is diluted in a weak 1 per cent salt solution and a certain quantity of this is allowed to digest portions of a 1 per cent starch solution. The result is estimated in units.

By the *Gross method*, or a modification of it, the secretions within the stool which act upon protein (meat foods or albumen) are studied for tryptic activity (protein digestion). The stool is added to quantities of 0.1 per cent casein solution and the result is estimated in units.

By a test in which simple fats like monobutyrin or ethylbutrate are digested into fatty acids and glycerine, the degree of lipolytic activity

(fat digestion) is studied. The quantity of fatty acids formed is the index of this activity.

Bacteriological Studies of the Stool—The feces normally consist of a vast quantity of bacteria. According to Strassburger, an outstanding authority, the bacteria by weight constitute one-third of the stool. Most of the bacteria are saprophytic (germs that live on decomposed matter), but not usually disease-producing. Only under rare conditions do some of these organisms produce disease, and then they appear in the stool in excessively large quantities. In typhoid fever the stool will present large numbers of typhoid bacilli. In tuberculosis large numbers of tubercle bacilli may be found in the stool. In dysentery the organisms characteristic of this ailment will be found in increased numbers.

Where abnormal symptoms such as diarrhea or looseness of the bowels exist, and the presence of blood, mucus, and pus is noted in the stool, the need for bacterial investigation is imperative. Special methods of staining and preparation are utilized for detecting these organisms.

Stool Examination for Parasites and Ova (Eggs)—Frequently gross and microscopic examinations of the stool reveal either the parasite or worm, segments of the worm, or ova (eggs) of the worm. The parasites are recognized by their characteristic appearance, as are the segments and ova. Tapeworms, pinworms, round worms, and the eggs of other worms are found occasionally in the stool and, of course, often serve to clear up the diagnosis of many obscure cases.

CHAPTER VI

Fluoroscopy and X-ray Observations

THE X RAY has enabled the physician to pursue an investigation of the digestive system which is unique, distinctly different from all antecedent methods, and exceedingly fruitful. It is concerned with the study of the shadows of the various organs. Since most of the digestive organs are hollow and through their air content alone furnish shadows which are poorly outlined, it is necessary to fill these hollow viscera with a substance which produces a more dense shadow, adequately outlining each organ as far as is consistently possible. Under these conditions, and after a thorough practical experience, the investigator is in a position to interpret properly and pass judgment.

Barium sulphate is the heavy metallic chemical substance which, when palatably prepared for ingestion, is easily swallowed and produces the shadows in the digestive tract essential for study. Various portions of the digestive system are studied at intervals, over a period of time; this is referred to ordinarily as a G.I. (gastro-intestinal) series. The size, shape, position, tone, movements, and defects of these various parts of the digestive system are open to more thorough investigation through fluoroscopy and X-ray photography, than through any other one method. It causes no discomfort to the patient and has proved of such value in the acquiring of true data as to make its employment most desirable.

Patients who are to be studied by X ray should, if possible, take either a laxative or an enema about 24 to 48 hours before the study, so that the bowels may be well emptied before they are filled with the shadow-producing substance. This will enable the bowels to be more completely outlined by the barium shadow-producing substance, and will aid in gaining a more normal view than the sometimes distorted one obtained when the bowel contents are retained. A pint of barium mixture (made either with malted milk or buttermilk) is usually given in the morning to a fasting patient who has had no breakfast; after

approximately fifteen minutes the patient is fluoroscoped in the dark-room. Immediately after the fluoroscopy (an X-ray illumination showing the stomach and duodenum in outline and in variations during movement), a few X-ray films are taken of the stomach with the person in both the erect and the prone positions. Then, six hours later, another film is taken to record the state of the stomach, but especially to determine if any of the barium is in this organ at that time. Normally all of the barium will have left the stomach within the first six hours; if it has not, the indication is that there is a defection in stomach emptying or an obstruction to the proper evacuation of this organ. Nine hours after the mixture is given, another film is taken to ascertain the distribution of the barium at this period. Most of the barium normally will be in the large intestine at this time. The 24- and 48-hour films also give evidence as to the distribution of barium, and aid in outlining the large intestine. In exceptional cases the physician, to further enhance his knowledge of the case, may feel it necessary to take 72-, 96-, and even 124-hour films. When an X-ray enema is needed to outline the large bowel more adequately, it should be given unhesitatingly. When gall-bladder investigations are required, a special gall-bladder dye is given by the mouth about sixteen or more hours before X-ray photographic films are taken.

Fluoroscopy—Fluoroscopy is observation by means of X-ray illumination in a darkroom, and furnishes information of a nature similar to that of a moving picture. The activity of the organs, consisting of movements of the walls and emptying of the barium contents, is observed and interpreted along with other information as to position, size, shape, and defects in outline. The study of fluoroscopy has become extremely valuable, but despite its importance actual photographic films should also be taken to make the investigation as complete and satisfactory as possible.

During fluoroscopy, the barium can be noted as it traverses from the mouth to the stomach after being swallowed. The gullet is thus subject to study, the stomach is observed during its disposition of barium contents, and the elimination of the material into the duodenum and the organs beyond may be seen. The upper part of the duodenum normally creates a shadow resembling a small bishop's cap in appearance; this portion of the duodenum is spoken of as the duodenal cap. Variation in the appearance of this cap may point to the existence of disease at this site, and an experienced physician will recognize the ailment quite readily. Of course, during the examination, the observer should also view the chest for abnormalities, thus

gaining some idea of the condition of the lungs, heart, and large blood vessels and the relationship of any discovered organic disease to the state of the gullet or stomach and also to the general welfare of the patient.

During the course of fluoroscopy, the first digestive organ to be examined is the *esophagus* (gullet). The gullet ordinarily commences at a level in the lower neck or throat and descends along the front of the spine through the chest and the diaphragm (muscular partition which separates the chest from the abdomen) into the abdomen (belly), terminating in the cardiac end (inlet) of the stomach. It is vertical in position and presents two or three curves in its course. At its commencement it is in the medium line of the body, but as it passes through the diaphragm, just before it reaches the stomach, it deviates forward and slightly to the left.

One of the best positions for esophageal study during fluoroscopy is the so-called right anterior oblique, during which the patient stands at an angle of 45 degrees to the fluoroscopic screen. Views should also be made in other positions to render the examination more comprehensive. If a fluoroscopic examination of the chest organs (heart, lungs, bronchi, and large blood vessels) could always precede a study of the gullet, a better understanding of the various relationships would be attained beforehand. The presence of tumors or enlargements of the heart and large vessels may alter the general relationships normally found in the chest, and even go so far as to produce displacements of the gullet or definite pressure upon this organ.

Usually the barium mixture will be seen to pass down the esophagus to the upper end of the stomach, where it is held momentarily before it enters this organ. The mixture will be seen to move along the gullet as a continuous stream, but occasionally it is separated into fragments which are seen at certain points of narrowing that are normally present. The longest retardation, though also of momentary duration, is at the cardiac end (inlet) of the stomach. Peristalsis (muscular contraction in waves), which moves along the tubular gullet at a rate of approximately one inch per second, is not always seen by the observer during fluoroscopy, but it may often be noted by a careful and keen investigator. Where symptoms suggest esophageal disturbance, a more detailed and cautious survey should be made. To insure for thoroughness, examination of the gullet may be made in prone, erect, and various oblique positions.

Abnormalities of the Gullet—Abnormalities of the esophageal outline or of its activity, as revealed by fluoroscopy and X-ray photog-

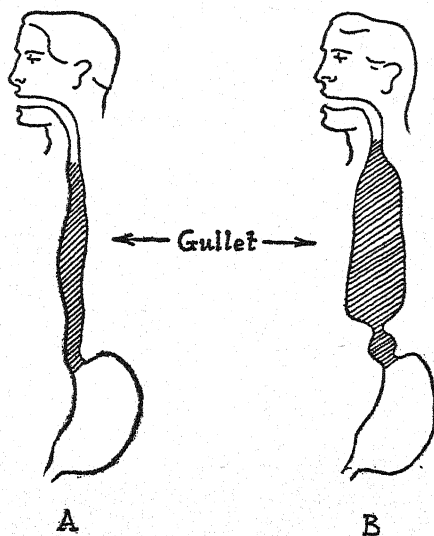
raphy, may result from disease outside of the gullet—but in its immediate neighborhood—as well as from disease within the gullet itself. In our discussion here, however, we shall confine our remarks chiefly to conditions involving the gullet proper. Some of the chief ailments which give rise to irregularities of contour within the esophagus are *cardiospasm* (contraction of the lower end of the esophagus), *cancer*, *ulcer*, *diverticulum* (pouch or sac), and various forms of *stricture*. When obstruction of the gullet occurs, it will usually be found to be more marked in diseases arising from the gullet itself than in those arising from conditions outside of this organ which create obstruction through pressure.

Esophageal Spasm—Esophageal spasm will cause the lodgment of the barium mixture above the stricture or obstruction created by the spasm. The lapse of time during which the material is restrained from its onward course is influenced by the severity of the spasm. In mild forms of spasm involving different portions of the gullet, the passage of the barium is often held up for a moment; this condition is spoken of as an *esophagismus*. When the obstruction is of a more lasting nature, the barium is seen to collect more definitely above the constriction level. In cases of moderate severity, the barium, although held up for a short time, will soon pass the obstruction in separate elongated fragments; but when the constriction is more severe the spasm may be sufficiently intense in nature to produce an overgrowth of muscular tissue at the point of constriction, and as a result an organic lesion rather than a nervous spasm has developed. Under such conditions the esophagus above the point of constriction usually undergoes dilatation (stretching), and the barium will be seen as a large accumulation of material in a widened or dilated portion of the esophagus.

This condition, when observed in any portion of the esophagus, is regarded as somewhat serious. It is the type of obstruction encountered in the condition known as *cardiospasm*, which, as the term implies, indicates a spasm of the muscular tissue at the cardiac end (inlet) of the stomach which joins with the lower end of the gullet. This is a rather common ailment and occurs in both mild and advanced forms. In its mild form it is frequently a reflex manifestation of disease in some other part of the stomach and bowel tract. When it persists for a long period of time, hypertrophy or overgrowth of muscle tissue as stated above, with consequent dilatation or stretching of the lower gullet, will ensue. It is in such cases that a funnel-shaped accumulation of barium is seen above the site of the spasm or stricture. This accumulation of barium will vary in size in accord-

ance with the degree of spasm and the degree of dilatation which has resulted. In some cases the esophagus has become dilated to a considerable extent, and as a result a large mass of barium will have collected for hours above the level of the spasm before it is forced through the stomach inlet. The contour of the esophagus surrounding the obstructed level is smooth in appearance.

Cancer of the Gullet—Cancer of the gullet occurs at various levels of the esophagus; it is more common at the cardiac end of the stomach



A—a normal gullet.

B—a dilated gullet above a narrowly constricted spastic manifestation referred to as cardiospasm.

and is characterized chiefly by obstruction, which may not reach the same degree of intensity as in cardiospasm but is nevertheless of sufficient development to cause great distress to the patient. The disturbance in swallowing may be pronounced, but the obstruction to the entrance of food into the stomach may not be great. The contour of the esophagus at the level of the lesion, however, is rather irregular as compared with the findings in cardiospasm. When the growth manifests itself at levels above the lower end of the gullet, the irregularity in contour is often more pronounced.

The experienced observer will have little difficulty in differentiating

cancer from the defects and smooth irregularities produced by benign lesions. Occasionally the gullet presents evidence of exaggerated peristalsis (contraction waves) above the level of constriction, and in some instances anti-peristalsis (waves of contraction upward in the opposite direction to normal) may be noted. These are signs of the muscular irritability produced by the obstruction. Where the growth or cancer invades a considerable portion of the wall of the gullet, defects in the outline of this organ may be seen and are spoken of as *filling defects*. These defects are significant X-ray signs of cancer. At times, because of the arrangement of the growth through its infiltration of the esophageal wall, a weakness of the wall in the immediate neighborhood of the growth develops and results in the formation of a diverticulum or pouch, which is readily seen through fluoroscopy or X-ray photography.

Diverticulum—Diverticulum of the esophagus is often seen in the gullet as the result of weaknesses in the muscular walls. There are two main types, *pulsion* and *traction*, which will be considered further in a later chapter. The *pulsion* type occurs more often than the traction type, and is usually found in the upper part of the esophagus near its junction with the pharynx (throat). It is very likely that this condition results from some congenital anatomical defect which has left the wall of the gullet at this point rather weak. Any increase in pressure within the gullet may cause a rupture at this weak point, hence the formation of a diverticulum or pouch. These pulsion diverticula have a lateral (on the side) or posterior (toward the rear) position and vary in size from a pea to a large pear. When filled with barium the sac appears rather smooth and round. By viewing the patient from different angles as well as in the erect and prone positions, the observer will obtain a good view of the size, position, and emptying possibilities of this sac. *Traction* diverticula usually occur at a lower level and are smaller in size than the pulsion type. They often result from inflammatory adhesions which have become attached to the gullet and pull upon this organ, forming a pouch by stretching the wall.

Ulceration of the Esophagus—Ulceration of the esophagus occurs in various portions of the gullet; upon healing of the ulcer area, scars or cicatrices form. As a result of this scar formation, stricture or narrowing occurs and obstruction may be noted through fluoroscopy or X-ray examination. As in the case of obstruction or stricture already referred to under cardiospasm and cancer, the extent of barium accumulation will depend on the degree of dilatation or stretching above

the stricture level. Ulceration in the lower end of the esophagus may be due to so-called *esophageal ulcer*, but occasionally ulcers occur at this lower level as well as at upper levels because of other causes, such as tuberculosis, syphilis, and the swallowing of caustic fluids like lye and carbolic acid.

Fistulae—Fistulae (canals or tracts) are frequently recognized by means of the X ray. The barium enters these spaces and shows communication between the gullet and some other organs, such as the trachea or bronchi. This condition may be due to the spread of inflammatory disease to the esophagus from neighboring organs such as the lungs, bronchi, and lymph glands.

Disturbances in swallowing or other symptoms indicating disability within the gullet may, through fluoroscopy and X-ray photography, reveal that they are due to the presence of *foreign bodies* within the gullet, such as coins, buttons, pins, dental plates, and bones. These objects may lodge at any point within the esophagus, especially at the anatomical narrowings of the gullet which are located above, near the entrance to the gullet, at the middle of the gullet, and at the lowermost end of the gullet.

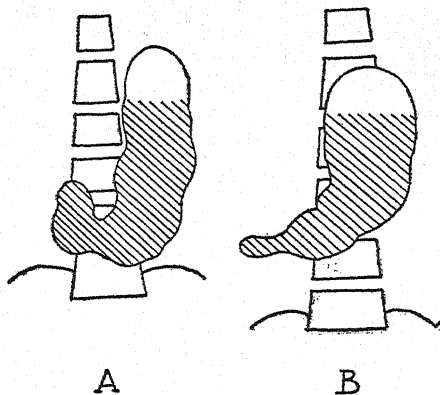
X-ray Observation of the Stomach—Viewing the stomach fluoroscopically or through recorded X-ray film furnishes considerable information of value not obtainable by other methods. The examiner, to begin with, should have a knowledge of the X-ray appearance of the normal stomach based upon practical experience before giving expression to opinions regarding abnormal conditions.

Because of variations in the appearance of the normal stomach in different individuals, mistakes in interpretation occur among inexperienced students. Because of the body build or so-called *body habitus*, a robust person normally has a stomach situated high in the upper abdomen and directed either obliquely or horizontally across it. Lanky persons who are tall and thin will usually portray a long J-shaped or vertical stomach. Others, in between these two extremes in body type, will present stomachs of fish-hook form or some modification of this, located in the mid-abdomen not too high or too low.

The keen student will observe the stomach from many angles, viz., shape, size, position, filling effects, outline, peristalsis, motor activity, and motility. The shape, as already stated, varies from that of a bull horn to a fish-hook or J-shaped form or some modifications of these. The position may be oblique, horizontal, or vertical depending upon the body build, the inherent tone of the stomach wall, and the conditions within the abdomen which influence the stomach. The position

also varies when the patient stands and lies down; the stomach is higher in the abdomen when he is lying down. In cases of colon distention, an upward pressure effect may cause the stomach to appear higher up in the abdomen. When the abdomen has lost a great deal of its tone (as in women who have frequently had children) the stomach sags to a lower position.

The filling of the stomach by the barium mixture is an important process to study. The barium as it passes through the lower end of



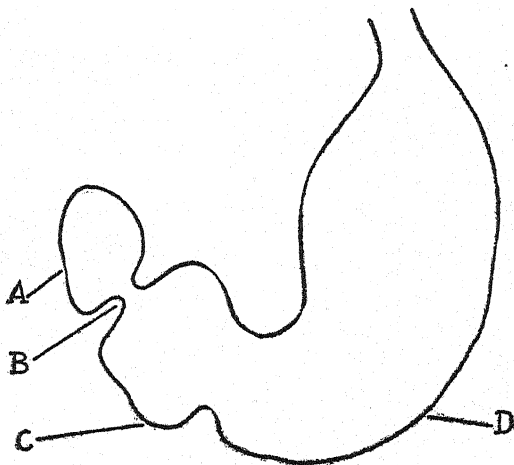
A—normal fish-hook-shaped stomach.
B—normal bull-horn-shaped stomach.

the gullet is slowly received by the stomach, which has relaxed somewhat for its reception. The stomach wall, by virtue of its muscle tone, wraps itself about the shadow-producing substance. This adaptation of the stomach wall, or embracing of the barium contents, is spoken of as the *peristole function*. The better the tone or hugging quality, the more thorough will be the filling. The outline of the stomach normally is smooth and uninterrupted, and presents no obvious indentations or protrusions, but in many instances of disease this is not the case.

As a convenience in study and observation, the stomach is divided by the observer into several parts: first, the upper part, or *pars cardia*; second, the mid-portion, or *pars media*; and, third, the lower part, or *pars pylorica*. In the upper part, to the left of the cardiac end of the stomach, one will always find a dark area marking an air bubble and referred to as the "magenblase." This shadow will vary in size de-

pending upon the quantity of air present. It will be large in air swallows and in stomachs which have, through fermentation, produced considerable gas.

About fifteen or twenty minutes after the ingestion of the barium, *peristalsis* begins to exhibit itself in the form of a furrowing along the marginal outline of the stomach. It is usually seen as a shallow manifestation beginning about the mid-portion of the stomach, but it



- A—the duodenum.
- B—the pylorus.
- C—the pyloric antrum.
- D—the stomach body.

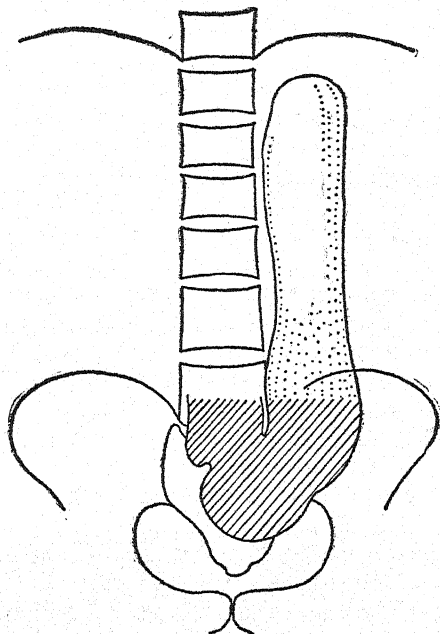
assumes a deeper character as it proceeds toward the lower part. It is seen most clearly on the greater curvature or left border of the stomach. It is occasionally seen on the lesser curvature or right border of the stomach. This function—*peristalsis*—occurs rhythmically from the moment food is eaten until its expulsion. The waves of muscular contraction occur at periods varying from twenty-two seconds at the beginning to nine seconds in the later stages of digestion. These waves force the contents of the stomach toward the outlet; at the pyloric portion of the stomach, where *peristalsis* is readily noted, the food to be passed through the outlet is separated from the remainder in the stomach. As the pylorus opens, the separated mass is ejected into the duodenum (uppermost small intestine).

The emptying of the stomach is influenced to a great extent by the *degree of peristalsis*. However, despite the fact that an increase in peristalsis is often associated with more complete and quick emptying of the stomach, it does not necessarily follow that each peristaltic wave is accompanied by an opening of the pylorus (stomach outlet). The emptying is influenced also by the *chemical nature* of the stomach contents. Normally no barium should be found in the stomach from three to six hours after it has been taken. A delay in emptying beyond six hours usually points to a disturbance in *motility* (motor function and emptying power), which may be due to nervous or psychic influences as well as to organic affliction. On the other hand, when the stomach empties too rapidly (before three hours) it may be due to a prolonged *relaxation of the pylorus* (stomach outlet) as a result of nervous influences or of organic disease.

When the muscle tone is normal, the entire stomach as revealed by fluoroscopy and use of the X ray shows its proper size and more normal position. When the muscle tone is increased (hypertonic) and especially when the entire organ is affected, the stomach may be contracted and smaller in size than normally. On the other hand, when the tone is decreased (hypotonic), especially when this is pronounced, the stomach appears large and may occupy positions beyond the normal limits.

Gastropptosis—Gastropptosis (low or so-called “dropped” stomach) usually goes hand in hand with general visceroptosis (low placement or so-called dropping of most of the visceral organs), but occasionally it exists alone. This condition is usually found in individuals of the asthenic type of build. People of this type have a more or less vertical stomach located somewhat lower than that of persons of the hypersthenic or sthenic types, but when the stomach assumes a definitely lower position it is regarded as ptosed or “dropped.” The X-ray film will usually reveal such a stomach as an elongated vertical organ, atonic (poor in tone) to a certain degree, and the barium content within its cavity will not closely embrace the wall, but rather will lie in the lower portion of the stomach and not fill out the organ properly. The stomach, as a rule, is from one finger’s breadth to a hand’s breadth or more below the iliac crests (crest or top of the pelvic or hip bones), depending upon the degree of loss of the stomach’s muscular tone. In extreme cases the stomach resembles a water trap in form, and has considerable difficulty in emptying itself. Often at the end of the six-hour period following ingestion the barium may still be seen in the stomach in fair quantity.

Spasm—Spasm, or muscle contraction to a pronounced degree, is the antithesis of atony (loss of muscle tone). It manifests itself in various forms and may involve one or more parts of the stomach at almost any level, or even the entire organ. Contraction of the whole stomach is regarded as a *diffuse spasm* in which, under the X ray, the stomach



Stomach is ptosed (dropped) considerably below the brim of the pelvis. Barium (shaded area) is confined to the lower pole of the stomach.

This condition is referred to as gastroptosis.

seems much smaller in size and width. The lower portion (pyloric part) may assume a distinctly tubular appearance. More frequently the spasm is localized and manifests itself at any level of the stomach. At the uppermost level, at its junction with the gullet, it is spoken of as *cardiospasm*. At its lowermost level, near its connection with the duodenum, it is spoken of as *pylorospasm*. At other levels, in between these points, it is spoken of as *localized stomach* or *gastric spasm*. Often it is seen plainly either on the greater curvature (left border) or on the lesser curvature (right border) as an *incisura* (deep

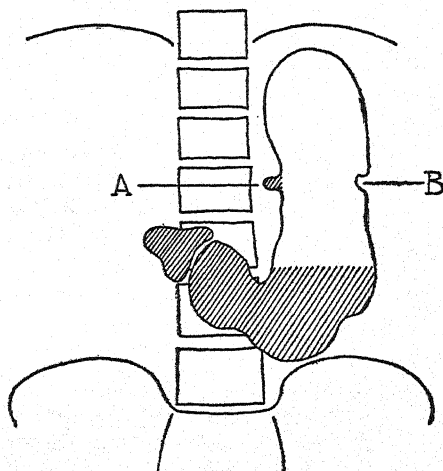
contracting wave or indentation of the outline). Such a spasm may occur as a purely functional expression, the result of psychic or neurotic disturbances, but more often it results either from organic disease in some other organ, such as the appendix, duodenum, or gall bladder, or from organic disease within the stomach itself, as in ulcer or gastritis (catarrh of the stomach lining). Often the incisura is found in the same plane or segment of muscle tissue in which the organic lesion exists, but on the opposite border. In exceptional cases the spasm is so pronounced that it affects the muscle tone of the entire circumference of the stomach at a definite level, and produces a so-called hourglass appearance.

In contradistinction to certain stomach *outline* disturbances created by spastic manifestations, these are true *filling* defects produced by *organic changes* within the wall of the stomach. Such defects occur in almost any part of the stomach wall and are due to disease located in the wall at the point of the defect. These defects are either *benign* or *malignant* in nature, and their size and shape will depend upon the degree of disease infiltration in the stomach wall. An inexperienced observer may misinterpret an organic defect for a spastic manifestation and vice versa, but this should not be the rule with an experienced student of the subject. An organic hourglass contraction may be due to an ulcer or cancer, but an interpreter who has seen many of these cases will find that the organic hourglass has certain characteristics which differentiate it from the purely spastic variety. Ulcers that have not perforated may evidence incisural spasms on the opposite border of the stomach but in the same plane level, whereas deeper ulcers which have penetrated the stomach wall will show a protrusion beyond the stomach alignment filled with barium; this is called a pocket or diverticulum, depending upon its size. The Germans have often referred to these smaller pockets as the "Nischen symptoms." When quite large they are called *diverticula*, because of their pouchy character and apparent separation from the stomach except for a small communication. In cases of large extensive ulceration, the healing ulcer, by virtue of the scar formation, will contract and force the stomach to assume a variation in shape and position, in some cases resembling a snail form.

An *ulcer of the stomach* will show X-ray evidences of irritability, the chief of which is spasm, either locally at certain areas in the stomach, or generally involving the entire organ; it will show also deformity of shape depending upon the degree of ulceration, spastic manifestation, outline defects created by contracting ulcer scars, out-

line protrusions created by penetrations of the ulcer through the stomach wall, accessory pockets, cavities or diverticula, increased peristalsis or evidence of anti-peristalsis (waves moving in the opposite direction from normal), and, rarely, an increased emptying, but more usually a delay of six hours or more in the emptying of the stomach because of either a spasm at the outlet or scar tissue contraction at this site.

A *cancer of the stomach* will, by X ray, present a variety of appearances, depending upon its location and extent. Defects will occur at the part of the stomach involved, and will be proportional in size to the



A indicates a penetrating ulcer, filled with barium, on the lesser curvature of the stomach.

B indicates a spasm on the greater curvature of the stomach opposite the ulcer in the same plane level.

degree of growth infiltration in the stomach wall. The defects in outline are readily seen and as a rule are rather irregular. The early lesions at the upper end or cardiac portion of the stomach are sometimes overlooked by some observers, but this is not a common occurrence. Peristaltic activity is either absent or decidedly diminished at the tumor areas. Occasionally, in cancer of the pyloric antrum, the stomach acts as a funnel, because of tissue infiltration, and thus facilitates the evacuation of barium. On the other hand, in obstruction at the outlet, the barium is retained in the stomach far beyond six hours.

At times the organic hourglass manifestation referred to above will characterize the cancerous condition.

Other conditions, such as *benign growths*, or *syphilitic infiltration* of certain portions of the stomach wall, may also produce in either the outline or the filling of the stomach defects somewhat similar to that occurring in cancer. Often a mistaken diagnosis is made in such cases. The condition known as *polyposis of the stomach* may present X-ray evidence of defects in the form of mottlings in the stomach shadow, or even outright defection in the positions of the shadow. Obscure or ill-defined defects may also be seen in cases of tuberculosis or varicose vein enlargements within the stomach wall.

A *small stomach* shadow is sometimes seen in cancer involving this organ, the result of contraction. This form is spoken of as *scirrhus cancer*. Another condition which is also characterized by a small-appearing stomach is referred to as a *leather-bottle stomach*, and is medically known as fibromatosis of the stomach. In these cases the outlet of the stomach is infiltrated and the muscles controlling closure do not function properly; hence the stomach empties rapidly.

A condition in which the X ray reveals the stomach or bowels to be *above the diaphragm*, in the lower chest cavity, may be due to either diaphragmatic hernia or diaphragmatic eventration, the latter believed congenital in origin.

At times *foreign bodies* are detected in the stomach and give rise to shadows conforming to the shape of the objects swallowed, such as glass, nails, and hairpins. Accumulations of swallowed hair, spoken of as hair balls, produce an uneven splotching of the barium shadow on the X-ray film.

Intestinal X-ray Observation—The first portion of the small intestine, the *duodenum*, is usually seen only at its uppermost few inches, because it is only in this part in which the barium will remain sufficiently long for fluoroscopic or X-ray portrayals to be made. This first portion of the duodenum is seen normally as a conical, or triangular, well-filled shadow, and is called the duodenal cap because it resembles a bishop's cap in appearance. The remainder of the duodenum and other portions of the small intestine (jejunum and ileum), because of the rapidity with which the barium speeds through these parts, is not well outlined or easily photographed. Normally the entire small intestine empties in from four to seven hours after the barium has been ingested. The *jejunum* will present indefinite feathery shadows which are too difficult to identify clearly. In from one to three hours the barium begins to collect in the *ileum* (lower small

intestine), where the intestine is seen as smoothly outlined loops. After six hours most of the barium has entered the large intestine and left only small traces in the distal part of the ileum. In from eight to nine hours, the small intestine should be entirely empty; if this is not the case, some disturbance is suspected. At times spasm or contraction will slow up the passage through the small intestine and thus enable an X-ray photograph of this part to be taken.

The large intestine is usually seen throughout its length. The barium appears in the cecum four hours after ingestion, and almost all of it is within the first portion of the colon (ascending colon) between four and eight hours after it is taken. After eight hours it advances slowly, and within twenty-four hours may be spread throughout the large intestine from cecum to rectum. At forty-eight hours most of the barium should have left this organ, but in constipation it may be retained for a longer period of time.

The colon, when filled with barium, will exhibit the *cecum* and *ascending colon* leading up to the *hepatic flexure*; from this point the *transverse colon* is seen leading on to the *splenic flexure*, and from here the *descending colon* leads to the *sigmoid flexure* and thence into the *rectum*. The colon will usually show *peristaltic activity* in the form of rhythmic, propulsive contraction in the ascending, transverse, and descending colon. This is spoken of as *hausstral segmentation*. In the first portion of the colon (cecum) *anti-peristalsis* or backward-pressing movements also are seen; these contribute to the mixing up of the intestinal contents at this point.

The *appendix* is often observed during the course of an examination of the large intestine, but the fact that its presence is noted or not does not in itself imply disease. For it to remain filled for two days or more after barium is taken may indicate disease, especially if it is tender to manipulation; when it does not fill out at all and the appendix area is tender to the touch, disease may also be suspected.

At times, when the large intestine does not appear to fill out properly after barium is given by the mouth and in cases where disease of the colon is suspected, a more thorough study may be attempted through the administration of a barium solution into the colon by way of the rectum. This is often referred to as the *barium enema*. From one to two quarts of solution are administered to the patient in this manner. Through this means the large bowel is adequately filled out and distortions more readily recognized.

X-ray Examination of the Small Intestine—As in the X-ray examination of the stomach, so also in the intestine, abnormalities are

looked for as regards *position*, *motility* (motor function or onward movement of contents), *peristalsis* (muscle contraction), *spasticity* (exaggerated muscle tone or heightened muscle contraction), *outline defects*, and *pressure effects* produced by influences outside the bowel. One or more of these manifestations or a combination of them will characterize disease affecting the bowel; sometimes the ailment is functional (nervous in origin), and at other times it is organic. The more pronounced or lasting these symptoms are, the greater the likelihood that they are of organic origin.

Duodenal Ulcer—The uppermost portion of the small intestine (duodenum) is the most common site for disease involving the small bowel. Fluoroscopy and X-ray photography are both utilized in the study of this portion of the bowel. Duodenal ulcer is a very common lesion occurring in countless numbers of people and often erroneously spoken of as stomach ulcer. The X-ray evidence portrays disease in the duodenum through one or more of the many manifestations referred to above. When the duodenum is diseased, the stomach frequently reflects signs of irritability and for that reason often leads to erroneous interpretations and mistaken diagnoses of stomach ulcer.

The duodenum just beyond the stomach, the first portion, is normally seen as a smooth, rounded triangular shadow simulating a cap. The base of the cap corresponds with the outlet of the stomach through the pylorus, whereas the apex corresponds with the junction of the first and second portions of the duodenum where the arch of this organ bends backward and downward. From this point on, an increased motor activity prevents the duodenum from remaining filled long enough to portray an outline of the well-filled organ except under diseased conditions. The sides or borders of the cap match up with the stomach borders and are often referred to as the lesser and greater curvature borders of the duodenal cap.

Ulcer of the duodenum may occur in any part of the wall of this organ, but its most frequent manifestation, as in the case of the stomach, is on the side of the lesser curvature or inner border. The manifestations may be varied, depending upon the degree of ulcer involvement and the degree of nervous irritability established. A deformity of the duodenal cap will also vary in appearance. Frequently spasm will show itself as an indentation on the border opposite the site of the ulcer in the same level of tissue. When ulcer is on the lesser border, the spasm will be seen on the greater border, and vice versa. This spastic evidence of ulcer, however, is usual in superficial lesions of short duration. On the other hand, in lesions of long standing where

induration (involvement of the deeper layers) has occurred or where scar tissue contraction has taken place, the deformity or indentation will occur at the point of ulcer development. This may also be attended by a spasm on the opposite border. Upon the nature of the ulcer from the standpoint of tissue involvement and local nervous reactions will depend the array of possible duodenal deformities.

In the common superficial or shallow ulcer, the deformity may result from spasm, as a *border indentation* only; in deeper lesions the deformities will occur in various forms as *permanent indentations* or projections resembling a clover leaf, a pine tree, or branched coral. At times a slight indentation or irregularity is seen on the basal border of the cap. When penetration or perforation of the wall has occurred a small diverticulum or accessory pocket will usually be noted. In some cases an interference or hindrance to the outflow of barium from the stomach causes its retention within the stomach beyond the normal six-hour limit; this may result from pronounced spasm of the muscular tissue at the stomach outlet or from actual narrowing of the caliber of the duodenum by a contracting scarred ulcer.

In some cases the stomach will show an *exaggerated peristalsis* because of the nervous reflex irritation created by ulcer in the duodenum. Because of this, the waves of contraction in the stomach may empty this organ too rapidly in the early stage of duodenal ulcer. In later stages of the disease a decrease in peristalsis results, and the stomach musculature loses some of its power of contraction. Hence a delay in stomach emptying may finally occur; this is often spoken of as *gastric stasis*.

In the case of a duodenal ulcer which has burrowed deeply through the wall and perforated, a small niche or pocket may be seen on the X-ray film. Within this pocket a small portion of barium is seen, with a small air bubble overlying it (Nischen symptom). The pocket may remain filled in this manner for many hours or days; such a condition is one of the most conclusive objective evidences of the existence of ulcer.

When ulcer occurs in the lower portions of the duodenum, spasm or scar tissue contraction at the ulcer level may produce an obstruction which, if well developed, will cause the duodenum above it to dilate and the barium to accumulate within it for many hours. This condition is often referred to as *duodenal stasis*. Occasionally a similar manifestation of duodenal stasis will result, not from duodenal ulcer, but from adhesions or pressure upon the duodenum from without, as in gall-bladder, gall-duct, or pancreatic diseases.

Occasionally obstruction manifests itself upon the X-ray film at other portions of the small intestine such as the *jejunum* and *ileum*. In such instances the barium, instead of appearing as feathery shadow masses throughout this portion of the bowel, will be seen as more solid accumulations (lengthy ribbonlike segments) conforming to the size and caliber of the bowel, and may be retained above the stricture point for from eight to twenty-four hours or more. This indicates *stagnation* of the intestinal contents beyond normal limits of time and may be due to enteroptosis (low intestine or "dropped bowel"), ulceration of the small intestine, tumor of the small intestine, tuberculosis, and other causes.

At times when the obstruction is pronounced, the bowel above the constriction level becomes dilated and the X-ray film reveals loops of gut filled with barium and accumulated air. When the wall has been involved to any degree, either by ulceration or tumor, a defect in filling may be noted in addition to the obstruction.

A comparatively common finding is the condition known as *ileal stasis*, which indicates a delay in the emptying of the lower small intestine. In such cases the X-ray film will reveal an accumulation of barium in the ileum over a period of from nine to forty-eight hours or more. This may result from many causes. A very common cause is irritability or actual disease within the large intestine just beyond the ileum. In this category will fall such affections of the colon as colitis, tuberculosis, adhesions near the junction of the colon and ileum following appendicitis, and ovarian or Fallopian tube inflammation, tumors involving the cecum (first portion of the colon), and pressure from diseased organs in the neighborhood of the colon and ileum.

A disease which in recent years has gained considerable attention is known as *regional ileitis*, an affection involving the lower portions of the ileum. On the X-ray film it often exhibits outstanding characteristics due to the constricted bowel lumen which results from the thickening of the intestinal wall. Because of this stiffened as well as constricted bowel lumen, the barium will often rush through this portion of the intestine, but enough of it will remain within the narrow lumen to portray a stringy appearance; or a delay of barium above the constriction will occur, with enough trickling through the diseased area to produce the string effect. This is referred to as the *X-ray string test*.

When loops of small intestine are well filled and clearly defined, a diseased state is suspected, because ordinarily the small bowel is indefinite in outline and poorly filled. The barium filling is usually noted

as feathery or fuzzy distributed material. The decisive outlining of loops of small intestine results from a concentration of barium and a delay in the onward movement. This may be due to a spasticity or hypertonic effect upon the intestinal musculature. It also occurs in retardation of small-bowel emptying, as in instances of adhesions about the ileo-cecal region (junction of the small and large bowels), appendicitis, tuberculosis of the bowel, and tumors of the small intestine beyond the filled area. Occasionally the loops of small bowel are pushed over or pulled to certain other parts of the bowel by outside lesions, as in tumors involving other abdominal organs, peritonitis, and adhesions from neighboring affections such as gall-bladder diseases, perforated gastric ulcer, and so on.

Large Intestine—Barium, after being taken by mouth, should be demonstrable by fluoroscopy in the *beginning* of the large intestine about two hours after the stomach is completely empty. The head of the barium column should be seen at the *hepatic flexure* (curve of the large intestine under the liver) in from six to nine hours. It should reach the *splenic flexure* (curve of the large intestine under the spleen) in from nine to twelve hours, and the *rectum* in from sixteen to twenty-four hours. When the films show decided variations from such findings, disease must be suspected.

Ordinarily the barium should have entered the large bowel and left the small intestine completely in nine hours. There are times, however, when traces of barium are still seen in the terminal portion of the small intestine (ileum) at this period; this may be the result of a so-called *incompetent ileo-cecal valve* (poor closure of the ileocecal structure at the junction of the ileum and cecum), as a result of which barium which had already reached the larger bowel leaks back again into the small intestine. Occasionally this same condition is found in cases of nervous or organic affliction involving the colon—especially its first portions (the cecum and ascending colon). In aggravated forms of disease involving the cecum, as in congenitally low displacements or the condition known as *low cecum*, and in aggravated forms of catarrh of the cecum, the tendency for a large accumulation of barium to occur in the ileum is not rare. This accumulation over long periods is often referred to as *ileal stasis*.

When the barium mixture is retained within the cecum for a prolonged period of time, the condition is referred to as *cecal stasis* or *cecal retention*. It may result from disease of the colon proper or from an appendix involvement. The barium may be lodged in the cecum not only for hours beyond the normal limit, but even for days.

Appendicitis—Appendicitis, either *acute* or *chronic*, is at times recognized by X-ray photography or fluoroscopy. Tenderness directly over the appendix is significant of an appendiceal irritability or even of inflammation. Lack of portrayal of a tender appendix may be the result of the inability of the barium to enter this organ, owing to the fact that the inflamed, swollen walls of the appendix have obliterated its lumen. On the other hand, in some cases an appendix that has remained filled for days, after the remainder of the large bowel has been entirely emptied, may be regarded as stagnated. When such an appendix is tender upon manipulation of the abdomen overlying it, an irritability or inflammation of this organ must be suspected. An appendix which appears under X-ray examination to be attached to other organs or shunted away from the normal position should be viewed as a probably diseased organ.

Colitis—In *colitis*, depending upon the nature of the ailment, the colon will portray various manifestations of irritability. In ulcerative or inflammatory processes, the wall may be involved rather deeply and therefore may lose its power to contract properly; hence it will not present its usual form of segmentation, spoken of as haustration. In addition, because of spasm or thickening of the wall, the caliber of the colon may be decidedly reduced. Where ulcers have formed, the colon shadow may present a flecked, marbled, or stippled appearance. In marked cases of mucous colitis, the colon often exhibits a narrowed, separated group of ribbon-like or even feathery shadows, corresponding to the vestiges of barium left in a colon that is otherwise completely emptied.

Diverticulosis—Diverticulosis is characterized by the presence of diverticula or small pouches of varying size within the wall of the large intestine; although likely to affect any portion of the colon, it most frequently involves the *sigmoid flexure* (the portion just above the rectum). The X-ray film usually portrays small rounded masses of barium along the edge of the colon, jutting out beyond the normal alignment. These are pockets filled with barium; they may be seen for days after the remainder of the colon has been completely freed of its barium content. When one of these pockets becomes inflamed, the condition is spoken of as *diverticulitis*; in addition to the barium filling in the pocket, the irritability created by the inflammation may produce a pronounced defect in the filling of the intestine immediately adjoining the lesion. The shadows within the diverticula vary in size from a pea to a hen's egg.

Constipation—Various forms of *constipation* are frequently recog-

nized from the X-ray film. The common *spastic* type is revealed through the spastic or increased muscle tone effects which are seen to involve certain portions or all of the colon. The portion frequently involved is the *descending colon*. As a result of this spasticity, elimination from the intestine is retarded. Another form of constipation, the *atonic*, will be seen occasionally; this is characterized by the retention of the barium over long periods in an intestine which exhibits poor peristalsis and poor muscle tone. In some cases, probably the result of a nervous depressive influence over the center controlling defecation (bowel movement), the X-ray film may show a rather large accumulation of feces in the lowermost colon and rectum, a form of constipation known as *dyschezia*. The barium may be delayed at this location for forty-eight hours or more.

Occasionally a pronounced and *obstinate constipation* is recognized on the film and found to be the result of kinks or bands produced by adhesions resulting from previous inflammatory diseases of the abdomen or, more rarely, from congenital adhesion bands which tend to encroach upon the bowel lumen. In some instances a *spastic form* of constipation occurs as a result of reflex irritation of the bowel from other sources, as in gall-bladder disease, gastric or duodenal ulcer, and diseases of the genital and urinary organs.

Tuberculosis—Tuberculosis, although not very common in this region, involves the *cecum* (beginning of the large bowel) and in its early stages may be recognized in the film as an irritability. Later manifestations of pronounced spasm, delay in emptying of the cecum and the small intestine above, absence of normal peristalsis, an irregular outline, and even defects may be noted. In rare cases the irritability is characterized by rapid emptying of the entire colon.

Carcinoma—Carcinoma (cancer) of the colon is usually revealed by the X-ray film as a defect in the filling of certain portions of the colon. The more pronounced the infiltration of the bowel wall by the growth, the more readily the defect is seen. The outline of the defect is usually irregular in this condition. When the growth is rather extensive and involves the wall to a considerable depth, obstruction of the bowel lumen may occur and this will be revealed by X-ray photography. When the obstruction is in the lower colon, an X-ray enema aids considerably in its demonstration, because of the opposition offered to the inflow of the barium mixture by the obstructing growth. The most common locations of cancer in the colon are the *cecum* (beginning of the colon), the *transverse colon*, and the *sigmoid flexure* (the lower colon above the rectum).

Abnormalities of the Colon—Abnormalities of the colon in the form of *misplacement* of various portions of this organ are at times found by accident and are usually attributed to *congenital* development. In other instances, misplacements are associated either with *adhesions* which pull organs to abnormal locations, or with *pressure* which forces them to abnormal sites.

Many other conditions of less frequent occurrence, such as *benign growths*, *foreign bodies*, and *enteroliths* (large or small masses of dry, hardened fecal matter), may from time to time be seen in the X-ray film.

Gall-Bladder Examination—Within recent years X-ray examination of the gall bladder has been made easier by the administration of a dye which presumably settles in the gall bladder. The dye, by its distribution throughout the gall bladder, invites the production of a shadow which outlines the organ and brings to the film a better view than was formerly obtained. This dye is known as tetra-iodo-phenolphthalein. It is given to the patient both intravenously and by the mouth. The latter method is the preferable and safer method, but the dye must be given in a dose sufficient to suit the case. More recently, improvements have been made upon this dye, and these have resulted in the production of better gall-bladder visualization.

The patient is usually given the dye sixteen to eighteen hours before the X-ray films are taken, and urged to follow certain rules as to abstinence from food during this period of preparation. After the required number of films are taken, the patient is instructed to eat food containing fat elements and proteins, which are presumed to stimulate an emptying of the gall bladder; after an hour or more the gall-bladder area is again X-rayed for the purpose of appraising the degree of emptying.

The normal gall bladder usually presents a pear-shaped shadow, well outlined, smooth, and of homogenous density. Normally variations in the appearance of the shadow will at times be seen. The shadow is located in the right upper portion of the abdomen underneath the liver, about one to three inches from the spinal column.

The diseased gall bladder frequently may not allow the dye to concentrate within its confines, and a shadow will therefore not be seen. On other occasions, when filled, it may exhibit an irregular outline because of inflammations or adhesions. Occasionally areas or shadows of lesser density (negative shadows) are portrayed within the gall bladder; these are believed to be due to the presence of *calculi* (stones) containing cholesterol. Shadows of deeper intensity (positive shad-

ows) when seen within the gall bladder are believed to be stones that have undergone *calcification* (infiltration with lime salt deposits).

Gall-bladder examination by means of X ray and this special dye has unquestionably been improved in late years. A better understanding of the nature of this organ in regard to its function, position, size, contents, and relationship to other organs has definitely been attained.

CHAPTER VII

Diseases of the Mouth

THE MOUTH, in which the preliminary process of digestion begins, has a number of functions to perform. A disturbance of any of these activities indicates either that disease is present locally in the mouth, or that the disorder is a reflex expression of disease at some distance, as in the stomach and bowels. The *tongue*, with its nerve endings near the surface, especially the taste buds, aids in the stimulation of secretion from the salivary glands (already described in Chapter I). The *nose*, with its sense of smell, is also in close relation to the mouth cavity through the pharynx (throat), and similarly aids in arousing the elaboration of saliva. The *teeth*, by breaking up the food through chewing, expose it to a more intimate and thorough admixture with the saliva (mouth juice), and thus enable the food elements to receive their first digestive treatment by the salivary ferment called ptyalin. As a result, the starchy portions of the diet are given their first digestion. In addition, the food is pressed into a mass or bolus as well as rendered mucoid or slippery, so as to facilitate its passage during swallowing through the throat and gullet on its way to the stomach.

The absence of a number of teeth, or the presence of unsound teeth, may hamper the preparation of food and thus invite improper digestion and absorption. Other diseases involving the muscles of the face, tongue, jaws, and lining of the mouth may give rise to similar disturbances, because of the defects in function created in the mouth. Occasionally diseases occur which produce either a reduced or increased secretion of saliva; this may affect the process of digestion, in the mouth proper as well as in the stomach. A lack of salivary secretion not only may invite local diseases within the mouth, but may, through improper chewing, improper insalivation of food, and swallowing, cause disturbances in stomach digestion. Also, too much secretion of saliva may, by virtue of its normal alkaline nature, oppose a thorough action by the stomach juice, the reaction of which is normally acid.

Pyorrhea—One of the commonest mouth conditions, *pyorrhea*, has kept the medical and dental professions occupied for many years in an effort to provide a means for its improvement or cure.

This disease occurs usually during middle or late life. It may have a hereditary or predisposing background, or possibly in some cases may result from infection due to lowered local resistance within the teeth and gums. The teeth may loosen and separate, and the gums may become inflamed. Often pockets are seen between the gums and the teeth. The gums frequently bleed and the breath may be foul. The front teeth are usually affected. When the condition is well advanced, purulent discharges (pus) from the teeth may be swallowed in sufficient quantity to arouse some form of indigestion. An X-ray examination of the teeth is indicated, and not only the attention of a dentist is warranted, but also a thorough medical examination. The X-ray film will reveal information regarding the existence of hidden cavities in the teeth, the degree of recession of the teeth from the gums, and the degree of involvement of the gums and adjoining bony structures of the jaw, and will give a more complete understanding of the true nature of the disease present.

Stomatitis—Stomatitis refers to a condition characterized by inflammation of the mouth cavity. There are various types of this disease.

CATARRHAL STOMATITIS—That frequently found in children and occasionally in adults is known as *catarrhal stomatitis*; it may occur as a purely local disease, or as part of a general condition in which the body resistance is low and the hygienic care of the mouth has been neglected. In some adults it is due to poorly fitting false teeth or broken, rotted teeth which create mechanical injury in the mouth, to which infection is added because of poor oral hygiene. In some cases it is created by dust inhalation as a result of occupational exposure.

The mucous membrane or lining of the mouth appears red and swollen, depending upon the degree of inflammation present, and the secretions of the mouth cavity are usually increased. Whitish patches may at times be seen upon the gums, tongue, or cheeks. There may be either a burning sensation or actual pain within the mouth, and often the patient will complain of an unpleasant taste, a bad breath, a poor appetite, and difficulty in chewing food.

ULCERATIVE STOMATITIS—Another form known as *ulcerative stomatitis* may be found in poorly nourished children and young adults. It is identified by the presence of ulcerations within the mouth. The condition may develop to a considerable extent, and because of tissue destruction the teeth may become loosened and fall out, the jaw bone

becoming definitely involved. It may occur as a result of malnutrition, as in *scurvy* and *sprue*, and also in cases of metallic poisoning (mercury, lead, phosphorus), especially in individuals given to the practice of poor oral hygiene. It is often identified with the condition known as *trench mouth*, and is believed in such instances to be due to infection by a special germ spoken of as *Vincent's infection* because of its relation to the disease known as Plaut-Vincent's angina. The symptoms are very much like those of catarrhal stomatitis, except that in addition, because of its severity, the gums and involved tissues near by bleed easily. Ulcerative areas may be seen, either a raw red or covered with grayish or whitish film. The teeth may become loose and may even fall out, and the sensation of burning or soreness in the mouth may be pronounced. As in the catarrhal condition, the symptoms will usually occur in exaggerated form. At times the patient may evince a moderate temperature. Healing of this ailment will depend upon the eradication of the cause, and weeks or months may be required for its accomplishment.

If an examination of the mouth secretion reveals the presence of *germs* which indicate the existence of trench mouth or Vincent's infection, the condition will respond to either the local or general application of arsenical medication. If streptococci are found, other specific treatment may be warranted. Certain local mouth washes are used, depending on the type and degree of inflammation present. Solutions of boric acid, hydrogen peroxide, thymol, potassium permanganate, and tincture of myrrh are employed. General constitutional treatment must not be overlooked, because it is of even greater importance in some instances than the local measures. Vitamin C and vitamin B complex may be appropriate medication. Under all circumstances a physician should be retained to advise the patient throughout the illness. At times drugs to relieve the pain are essential, and only such foods as require little or no preparation in the mouth cavity should be utilized for a time.

Various other forms of stomatitis occur occasionally. The symptoms complained of are to some extent similar, but they may vary in degree, depending upon the extent or underlying character of the condition. The duration of the disease will also depend upon the efficacy of the treatment employed. The diseases will manifest themselves by either small or large spots or areas of eroded tissue; these may be either red, white, or grayish white in color, and located upon various parts of the lips and cheeks opposite the teeth. Increased salivation or mouth

watering may be a prominent symptom, and pain of a lesser or greater degree may occur in the mouth.

APHTHOUS STOMATITIS—The condition known as *aphthous stomatitis* is not uncommon and is believed to be of either a toxic or infectious origin. It is often found in persons suffering from indigestion, probably the result of dietary indiscretion or poor vitamin intake; in some instances it accompanies such underlying debilitating ailments as diabetes and pernicious anemia. Some authorities feel that it is related to hoof-and-mouth disease, which certain individuals acquire from animals.

THRUSH—A condition known as *thrush* is a form of stomatitis often seen in children who are weak and debilitated as a result of other ailments or because of an insufficiency in the food supply or a defection in the absorption of food elements. The disease occurs in infants via the route of infected nipples or feeding utensils, and is believed to be due to an infection by a fungus or yeast type of organism.

NOMA—A form of stomatitis which sometimes occurs in children and usually develops into gangrene is known as *noma*. In its earliest stage it resembles ulcerative stomatitis (described above), and it is occasionally associated with such infectious ailments as scarlet fever, diphtheria, and measles.

TUBERCULAR STOMATITIS—This disease may occur in persons who are run-down and debilitated, particularly in cases where a tuberculous condition already exists in some other part of the body. This form of the disorder is exceedingly difficult to treat satisfactorily. The ulcerative lesions may enlarge as well as persist for long periods of time before showing indications of healing, if any.

SYPHILITIC STOMATITIS—This stomach ailment is rare today as compared with its occurrence in previous periods, because of the great advancement in our treatment of constitutional syphilis. When it occurs it usually is a late manifestation of the disease, and may appear as areas of ulceration.

CHRONIC STOMATITIS—A chronic form of stomatitis may also result from irritation of the mouth by smoking or chewing of tobacco, or from improperly fitting false teeth and improper mouth cleansing.

The treatment of these different forms of stomatitis will depend upon the type and degree of inflammation present and upon the general condition of the patient. Local measures for cleaning the mouth and for treating the lesions may be employed, and such constitutional means as are indicated should be resorted to. A physician should al-

ways supervise the treatment; under no circumstances should a case of stomatitis be handled otherwise.

Cancer of the Mouth—Cancer of the mouth is a not infrequent manifestation occurring usually in middle or later life. It is a growth originating within the lining of the mouth, and often develops on the lower lip or in the cheek. It is believed to be due to irritation of either a chemical or a mechanical nature, as in the case of smokers, tobacco chewers, or those with rough false teeth or broken, carious teeth. The growth may vary in appearance from that of a flat to that of a protruding excrescence, and may or may not break down or ulcerate. At times it develops upon the base of a long-standing innocent lesion which has undergone chronic irritation.

The symptoms will depend upon the exact site of the lesion within the mouth, and pain is often the chief complaint. Interference with chewing, swallowing, and talking may arise, and such reflex pains as earache and headache. Salivation or dribbling from the mouth is common, and when infection of the growth complicates the condition the symptoms may become exaggerated. The treatment usually advised is local radium or X-ray therapy, or attempts at complete removal of the growth by surgery.

DISEASES OF THE TONGUE

Glossitis—Inflammation of the tongue occurs occasionally and presents itself either as an acute or as a chronic process. It may result from injury to the tongue caused by accidental biting or burning, or from irritation as in tobacco chewing. It may also accompany infectious diseases such as scarlet fever and syphilis. The inflammation is at times only local, as in the case of mild injury, but sometimes widespread, involving a great portion of the tongue, as in cases of extensive damage or as a complication of a constitutional disease. When the tissues of the tongue are involved to a great degree, the entire tongue may appear swollen and enlarged.

The symptoms of glossitis vary somewhat. In the acute form the pain may be excruciating, whereas in the chronic form it is likely to be less severe. When the tongue is swollen and consequently much enlarged, the mouth cavity is difficult to close and the tongue may even protrude beyond the lips. The surface of the tongue may exhibit limited or widespread coverings of muco-purulent matter, or small areas of excoriation or ulceration. Fever is often present, its intensity varying with the nature and extent of the infection and inflammation.

The lymph glands in the neck and the salivary glands in adjoining parts of the mouth may also become swollen and tender. The flow of saliva is usually increased, and the taking of food may become a difficult and painful matter.

The treatment of the acute condition is similar to that employed in the acute form of stomatitis described above. When the infection of the tongue leads to abscess formation, surgery may be regarded as necessary.

Ulcers of the Tongue—Ulcers of the tongue are frequently the result of injury; they may be either shallow or deep, with hard edges. At times ulcers occur which are not due to injury and these may be tuberculous, syphilitic, or cancerous in nature. The tuberculous variety is usually shallow, with excavated edges, grayish yellow in color, and painful. Syphilitic ulcers and cancerous ulcers are usually deep and grayish in color, with ragged edges. They are all tender, and their true nature is determined by further study and observation. The treatment of all ulcers is to a certain extent similar. In addition such special means are employed as the specific ailment warrants. For instance, in tuberculosis the quartz or alpine lamp may be indicated. In syphilis, constitutional treatment is administered through the injection of salvarsan or its derivatives, and the additional use of bismuth and mercurial preparations. In cancer the employment of radium or X-ray therapy or surgery is considered important.

Geographical Tongue—A tongue which, because of the denudation of certain of its areas, gives rise to a geographical maplike appearance on its surface is called a geographical tongue. This is often a chronic process, and may or may not be accompanied by soreness of the tongue. Some authorities regard it as familial or inherited; others, as digestive in origin.

Nigrities—Another rare condition, often called hairy tongue or black tongue because of its dark appearance, but to which the medical appellation of *Nigrities* is given, is characterized by an elongation and scaly hardening of the surface cells of the tongue, which become darkly discolored.

Leukoplakia—Whitish patches of varying extent, the result of overgrowth of the tongue surface tissue and its deeper layers and often involving the cheeks as well, is known as leukoplakia. This condition is by some students regarded as hereditary, but it is believed more likely to be the result of irritation from smoking, chewing, the drinking of liquor, or other forms of local aggravation such as those which occur in glass blowing.

Glossodynia—This affection, a neuralgia of the tongue, occurs as a rare malady; it may result from disease in the mouth near by, especially in instances of inflammation of the lymphoid tissue at the base of the tongue, known as the lingual tonsil. Treatment of the lingual tonsil or its removal may eradicate the neuralgia. Other general or local measures may also be employed, as in any other form of neuralgia.

Cancer of the Tongue—Cancer sometimes affects the tongue and may result from irritation of a physical nature, such as that caused by carious, jagged teeth or broken false teeth, or of a chemical nature, as sometimes occurs in the use of tobacco, liquor, or other chemical substances. It also may develop on the base of some former benign disease like leukoplakia, which exhibits whitish patches, the result of an overgrowth of the tongue surface tissue, or on the base of a wartlike surface condition known as *ichthyosis*. The symptoms are similar to those already mentioned in connection with ailments of the mouth and consist especially of swelling and enlargement of the tongue, local and radiating pain of varying degree, salivation, and difficulty in chewing, talking, and swallowing. The treatment usually advised, in addition to local palliative medical measures, is X-ray or radium therapy or surgery, the choice depending upon the judgment of the attending surgeon.

DISEASES OF THE SALIVARY GLANDS

The three pairs of salivary glands, *parotid*, *submaxillary*, and *sublingual*, together constitute the group referred to as the salivary glands; one of each type is found on either side of the head. Diseases may occur in one or more glands, and may result in the production of such symptoms as swelling or diminution of the size of the gland, increased or decreased secretion of saliva, and pain or other symptoms of difficulty affecting the functions of the mouth.

Ptyalism—Ptyalism, or *increased salivary secretion*, is a condition which may occur because of a local disorder within the mouth, as well as reflexly from a distant source such as the stomach. In this condition the flow of saliva is increased. It may result from local ailments involving the teeth, gums, tongue, cheeks, and throat, and from ailments involving other organs such as the brain, stomach, bowels, and gall bladder. Nervous influences such as worry, anxiety, and excitement of one form or another may produce an increased flow of saliva.

When the increase in the salivary secretion becomes excessive, the

patient will be forced to swallow frequently to prevent accumulation in the mouth, lest dripping from the mouth ensue. When the saliva trickles into the larynx violent coughing spells occur. The sense of taste may become impaired, and the salivary glands may become swollen because of overactivity. Speech is often disturbed, and sleeping may become a hardship because of the constant trickle of saliva. Swallowing of large quantities of saliva may prevent proper digestion in the stomach, thus giving rise to stomach disturbances. The treatment of ptyalism will depend upon the cause in each case. Local mouth conditions must be corrected, and distant sources of reflex irritation should be attended to. General measures which attempt to reduce the activity of the salivary glands may be employed. Local astringent mouth washes also may prove of service to alleviate the distressing symptoms. A physician should keep close observation over such a case.

Xerostomia—Xerostomia, or *decreased salivary secretion*, is frequently encountered in persons running a protracted fever and is spoken of as *dry mouth*; it is the result of inadequate elaboration of saliva by the salivary glands. It also is noted in individuals who, because of debilitating influences and poor appetite, eat poorly and chew food less frequently each day than they should. Dry mouth may occur in cases afflicted with such diseases as diabetes, kidney ailments, tuberculosis, and digestive disturbances particularly associated with vomiting and diarrhea. It will also be seen in persons undergoing considerable mental strain and anxiety, the result of nervous influences which depress the elaboration of saliva. In older people, during senescence, actual organic changes of a degenerative nature occurring in the salivary glands may contribute to the production of this condition. Occasionally a stone or calculus develops within one of the salivary ducts which ordinarily conveys the secretion into the mouth, and because of its blockading effect the secretion is suppressed, not only in the duct where the stone is lodged but also reflexly in the other ducts, because of some depressive nervous influence. Thus it is evident that influences playing upon the nerves controlling the activities of the salivary glands are to be reckoned with seriously when dry mouth occurs.

The treatment naturally will depend upon the nature of the underlying cause of the condition. In case of calculus or stone, an effort at removal must be attempted. In other cases, frequent practice in the art of mastication or chewing must be resorted to. The chewing of gum, slippery elm, or bitter or spicy medicaments may be indulged

in. Other medicines aimed at inciting a flow of saliva and electrical stimulation are frequently advised.

Salivary Gland Enlargements—Enlargement of the salivary glands is a condition of which most people are aware in the disease known as *mumps*, which occurs chiefly in children. In this ailment it is usually the parotid glands which are involved. Swelling of the salivary glands may also occur in other diseases such as malaria or typhoid, and in such chronic ailments as tuberculosis or syphilis.

At times enlargement occurs because of the actual retention within a gland of its own secretion, because of the obstruction of a salivary duct by a calculus or stone, or because of some congestion or inflammation within the duct. Any of the glands—parotid, sublingual, or submaxillary—may be involved, more frequently the last. The gland is swollen and the tissues overlying it may feel warm to the touch. Pain may be present in varying degrees, and is aggravated by chewing or movement of the mouth. A sensation of comparative dryness may also be present in the mouth. The treatment will depend upon the cause.

If a calculus is present, it is best to remove it. If the condition is due to an inflammation or congestion within the salivary duct, medical measures or the passage of a bougie, or “sound,” into the duct may prove of benefit. Efforts to allay the inflammation must be made.

Simple Inflammation—Simple inflammation of the salivary glands occurs occasionally by direct extension of inflammation in other portions of the mouth or throat, or through the blood stream from more remote parts of the body. Sometimes this occurs after large dosages of certain medicaments have been taken internally, as in the case of mercury, lead, iodine, or arsenic. One or more glands may be involved simultaneously. The *parotid* is more frequently involved in this type of inflammation than are the *sublingual* or *submaxillary* glands. The symptoms will depend upon which particular gland or glands are affected. If the parotid is involved, the pain or tenderness will be in the area just in front of the ear and the ear may stand out prominently. If the submaxillary or sublingual glands are involved, the pain or tenderness will be noted under the jaw or in the floor of the mouth. The inflammation is usually attended by swelling, warmth in the region of the swelling, some degree of redness of the tissues, and fever of varying degrees. At times chills may be experienced. The glands may feel hard and exhibit tenderness. Complications, such as deafness and noises in the ear, may become manifest. Movements of the mouth may be limited and painful, and swallowing may become difficult. Occasionally involvement of neighboring nerve structures produces

temporary paralysis of the face and mouth, and the uninvolved salivary glands may either oversecrete or undersecrete, thus creating ptyalism or the opposite condition, dry mouth. The breath may be fetid.

The treatment will require proper mouth hygiene and the local use of either a hot water bottle or an ice bag, whichever is deemed advisable by the attending physician. Internal medication to counteract the inflammation, such as salicylates, sulfa drugs, or other forms of antiseptic medication, may prove of value. Sometimes surgery is indicated to relieve accumulations of pus, and food must be restricted to liquids for an extended period of time.

Disturbances of Taste—Disturbances of taste in the form of *loss or reduction in taste* (ageusia), *increase in taste* (hyperageusia), or *perversion of taste* (parageusia) may occur occasionally in certain individuals; these are usually of nervous origin. At times they occur as expressions of local nerve disorders within the mouth, or because of some disturbance in the brain itself, and again as a hysterical effect. Occasionally these disturbances of taste may be traced to disorders in other organs, such as the liver, bowels, and kidneys.

Foul Breath, or Fetor—Foul breath, or fetor, may result from various causes. Some of these causes are *bad teeth*, *diseased gums*, and *pockets*. Accumulation of small amounts of food which undergo fermentation or putrefaction may be confined to the *throat* behind the nose, or may extend to the crypts (spaces) of the tonsils as well as to other spaces in the throat, emitting a foul odor. Sometimes diseases of the various *nasal sinuses* will give rise to this disagreeable state. It is not to be forgotten that conditions lower down in the *bronchi* and *lungs* may frequently contribute to the production of foul breath; the effects of this will often be noticed during association with persons suffering from pulmonary tuberculosis, chronic bronchitis, and lung gangrene. Individuals afflicted with digestive ailments, especially those in whom there is a retardation in the onward propulsion of food as in disorders of the gullet, stomach, duodenum, gall bladder, and bowels, may give frequent evidence of foul breath.

Successful treatment, of course, will require a recognition of the true underlying cause, if this is possible. Gargles, antiseptic mouth washes, and the like are advised, and smoking is usually interdicted. Diseased teeth should be repaired or otherwise eliminated, and the gums treated. Other general measures aiming at the correction of processes which cause this foul breath should be instituted.

CHAPTER VIII

Diseases of the Esophagus (Gullet)

DISORDERS OF THE GULLET, the organ which conveys food from the throat to the stomach, occur in many people from time to time, although not so frequently as do disorders of the stomach, gall bladder, or bowels. They manifest themselves in the form of inflammations, nervous disturbances, tumors, ulcerations, obstructions, and sacculations (pouch formations).

Esophagitis, or Inflammation of the Gullet—Esophagitis expresses itself in various forms. One form, spoken of as *catarrhal*, often results from injury to the lining coat of the gullet following the swallowing of irritating substances. The swallowing of a hard substance, a sharp object, anything too hot, or various active chemical irritants may be the initiating process in the production of inflammation. At times it may follow as a complication of an affection near by, such as diphtheria of the throat. As a result the lining tissue may secrete or throw off either thin fluid or mucus (a heavier, slimy material).

In another form of the disorder, spoken of as *purulent esophagitis*, the inflammation is attended by pus formation. This type of inflammation of the gullet may result from affections occasioned by foreign bodies which have entered its lining tissue or damaged it, or from extension of disease in some neighboring organ, such as tuberculosis of the lymph glands of the chest, or other forms of infection involving tissues near by.

Occasionally one hears of attempts at self-destruction, or poisoning by mistake, through the taking of lysol, acids, alkalis, iodine, and mercury, as a result of which the lining of the gullet has suffered great damage. This damage is characterized by destruction of either the superficial or the deeper layers of the gullet mucosa (lining) and is known as *corrosive esophagitis*. This type of lesion is often difficult to heal, and results in scar-tissue formation.

A *chronic inflammation* or *catarrh* of the gullet may occur in some people in middle life or later years, because of a congestion of the

blood vessels of the gullet which has existed for a long period of time. This takes place in individuals suffering from heart or circulatory diseases, from liver ailments, and from lung conditions.

The symptoms of esophagitis will vary with the type of inflammation present. Mild forms exhibit mild symptoms, whereas severe forms produce serious and distressing complaints. Difficulty in swallowing may vary from mildness to severity, fluid foods being more easily tolerated. A sensation of discomfort or pain is frequently felt behind the breastbone (sternum); this may be noticed only during the act of swallowing, or it may be constantly present until the condition is healed. Some cases are attended by fever, but others are not, depending upon the severity of the inflammation. Because of a limitation of the ability to eat and swallow, the suffering experienced by the individual causes a loss of weight and general weakness. At times pain or discomfort radiates into various parts of the chest and back.

The treatment of these inflammations of the gullet will depend upon the type of involvement and the nature of the symptoms. The swallowing of food should be reduced or limited for a period of time, in order to rest the diseased tissues. Feeding in severe cases may be limited to the administration of food by the rectum or to injection either into the deeper layers of the skin (hypodermoclysis) or into the veins (intravenous injection). In mild cases the swallowing of only liquid foods may be required for a period of time, and solids will be given only after pronounced improvement warrants. In cases where strong alkalis have been swallowed, mild acids should be taken immediately afterwards; vice versa, when strong acids have been swallowed, mild alkalis are taken for counteraction. Occasionally surgery is indicated to open abscesses of the gullet, but only at the hands of well-trained surgeons. In many instances, after the acute stage of the illness is passed and scar tissue formations result in the production of a stricture, it may become necessary to pass certain instruments called bougies, or dilators, through the gullet to prevent its complete closure and to allay permanent stricture formation. A case of this kind may require medical observation or treatment for many years. Fluoroscopy and X-ray examinations are performed frequently to ascertain the progress of improvement.

Ulcer of the Esophagus—Ulcer of the esophagus involves usually the lowermost portion of the esophagus, and more rarely the middle or upper parts of the gullet. Most authorities feel that an injury to the gullet, usually from the swallowing of coarse or sharp foods, may have been the initiating cause of the ulcer. When the damage inflicted is in

the lower part of the esophagus and some of the acid stomach contents are regurgitated into the gullet, the injured portion is further irritated by this stomach material and an ulceration frequently results.

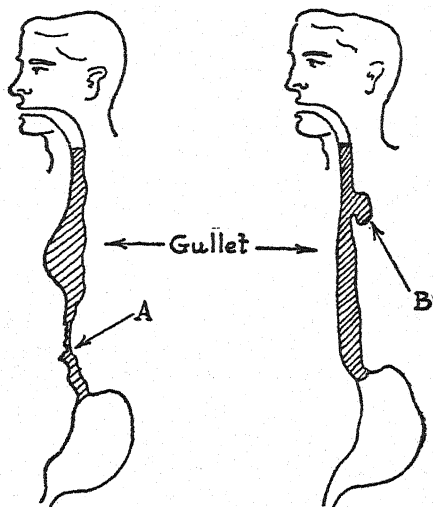
The symptoms may be mild or severe, and the degree of pain may vary depending upon the depth of the lesion and the sensitiveness of the patient. Pain is often associated with swallowing and manifests itself in the chest at a level related to the ulcer area through a nervous reflex. Spastic pain often accompanies this condition and may prove excruciating and penetrating. The discomfort may vary from the sensation of constriction to that of pain in different degrees. In ulcer of the lower gullet the discomfort is felt in the lower chest behind the breastbone or in the uppermost pit of the stomach (upper epigastrium). At times reflex manifestations such as tickling or choking in the throat, or larynx, may arise, or an increased flow of salivary secretion may ensue. The appetite is usually poor and the nutrition reduced because of the swallowing difficulties: therefore a pronounced loss of weight occurs. At times nausea and vomiting take place; when bleeding occurs from the ulcerated area, blood may be seen in the vomitus. When healing occurs with scar formation, a stricture or obstruction will follow, as a result of which swallowing is disturbed and, in order to rid the gullet of the accumulated food, vomiting spells are frequently indulged in. An X-ray study including fluoroscopy will often clearly reveal the true nature of the condition. In certain instances an instrument known as the esophagoscope is passed into the gullet; through this the tissues lining this organ may be directly observed.

The treatment will depend upon the seriousness of the symptoms. Some patients require rest in bed, others remain ambulant (walking about). Simple, shallow ulcers heal rapidly, but deeper lesions more slowly. Ulcers having a tubercular basis, of course, are intractable and require the general hygienic therapy needed in any pulmonary tuberculous condition. Sometimes complete abstinence from the swallowing of any kind of food is ordered, and feeding is confined to the rectum or administered through a duodenal or small stomach tube. In addition, intravenous feeding with sugar and salt solution may prove valuable. Other medical measures as prescribed by the physician, such as mild alkali drinks and bismuth paste, may be employed. Direct treatment of the ulcer through the esophagoscope is occasionally resorted to, and, where obstruction threatens, the passing of the bougies or dilators to stretch the scar tissue area is often indicated.

Diverticula of the Esophagus—Diverticula of the esophagus, or pouches and dilatations of the gullet, occur infrequently. When small

they may give rise to few if any symptoms, but after increasing in size they usually cause great discomfort. There are two types of diverticulum, *pulsion* and *traction*.

The *pulsion* pouch or pocket is created when the lining of the gullet is forced through a weak spot or breach in the gullet wall. This



A portrays a moderately dilated gullet above a constricted irregular narrowing due to cancer.

B portrays, leading off from the gullet, a pocket due to a diverticulum.

weak spot is probably congenital, dating back to childbirth; but the pouch did not form until later, through the influence of pressure from within the gullet upon the lining tissue overlying the wall defect. Indiscretions such as fast eating, swallowing hard objects, and the bolting of food will increase pressure within the gullet and possibly cause an enlargement of the wall defect; as time goes on, the pouch, which at first is exceedingly small, becomes quite large and forms a sac. This type of diverticulum is usually found in the upper portion of the esophagus in older people.

The *traction* diverticulum is formed through traction pressure or by pulling upon the gullet from without, in contrast to pressure upon the gullet from within as in the case of the *pulsion* diverticulum. It usually results from the spread of inflammatory conditions to the region of the esophagus from some other focus such as the bronchial

lymph glands. The traction diverticula are usually multiple (occurring in groups), in contrast to the pulsion diverticula which are usually single. The traction diverticula are as a rule much smaller than the pulsion diverticula, and when of small size may give rise to few if any symptoms. Individuals suffering from pulmonary tuberculosis or syphilis may develop this form of esophageal dilatation.

In pulsion diverticula, the severity of the symptoms will depend upon the size and location of the pouches. The small diverticula may exist for years without producing serious symptoms, whereas the larger diverticula usually cause considerable discomfort. Many of these patients have considerable difficulty in swallowing, and when the sac is located in the upper part of the esophagus they experience a sense of fullness in the neck. This is frequently followed by attacks of violent coughing, as a result of which the sac—which has become filled with food during the process of swallowing—may empty itself by a regurgitation of the accumulated food into the mouth. If the sac is filled with food and is not emptied over a period of time, putrefactive changes may occur, cause irritation, and even damage the lining of the sac. Under such conditions the symptoms become aggravated. At times, fortunately, patients are able to empty the sac by simple massage in the region of the neck overlying the area involved; in this way they obtain relief and experience little difficulty. The larger the sac, the more aggravated the symptoms usually become; because of the inability to swallow, malnutrition may supervene and even result in death.

Because traction diverticula usually occur in the lower half of the esophagus and because the sacculations are not very large, they cause much less suffering than the pulsion type. The symptoms are usually few, and only when food has been lodged in a pocket for a lengthy period of time will an irritation or ulceration of the diverticulum lining result. Then symptoms of an aggravated form may arise. Occasionally the ulceration may lead to perforation into the lung or bronchial tubes, and set up severe inflammation such as pneumonia or gangrene. When this occurs the situation is indeed grave.

Patients suffering from pulsion diverticula should be operated upon if the condition permits, and if the operation is not regarded as too dangerous. However, if surgery is contra-indicated, it may be deemed necessary to teach the patient the art of swallowing a stomach tube, through which he will be able to feed himself. In this way, these patients will evade a development of the symptoms occasioned by the entrance of food into the diverticulum. In the simpler cases, where the

patient is able to swallow food without its giving rise to distressing symptoms, it is advisable to adhere to simple, non-irritating foods to be taken in small quantities, slowly, at intervals. Fluid and semi-fluid foods are best tolerated. Patients suffering from traction diverticula usually have fewer symptoms and require less attention and consideration than the other cases, but a proper bland and non-irritating diet should always be adhered to. In very serious cases of diverticula of the gullet, where swallowing becomes increasingly difficult and the general body nutrition suffers greatly, it may become necessary to perform a stomach operation in which a gastric fistula or passage in the abdominal wall is developed; through this fistula food may be directly transmitted to the stomach.

Esophageal Obstruction—Obstruction of the gullet may result from a multiplicity of possible causes; the symptoms will depend in great measure upon the actual location of the obstruction within the gullet, and on whether it is organic or functional in nature. In the majority of instances the obstruction is in the lowermost part of the esophagus; if of pronounced development, it will invite a dilatation of the gullet above the obstruction level. In the early stage of the obstruction, the muscular walls of the gullet will hypertrophy (grow to excess) so as to enable the muscle tissue to develop enough power to propel the food through the lowermost opening, known as the cardia, despite the hindrance offered. When the muscular walls of the gullet perform efficiently in emptying this organ, the caliber of the gullet retains a normal or approximately normal measurement; but, when it is inefficient in its power of evacuation, the gullet begins to undergo dilatation (stretching) and the swallowed foods are dammed back above the point of hindrance.

One of the most common affections of the gullet characterized by obstruction at its lowermost level is spastic in nature and is known as *cardiospasm*. This variety of obstruction is believed to be due to a spasm of the muscle fibers distributed in circular fashion about the lower end of the gullet at its junction with the uppermost end of the stomach. When the obstruction has existed for some time, the degree of dilatation or stretching of the gullet immediately above the constriction is also well developed. This spastic manifestation is not always of purely nervous origin, but may be a nervous reflex process associated with ulcer or with other erosions of tissue near the spasm level or at a distant point, as in diseases of the lower portions of the stomach, duodenum, gall bladder, appendix, or even the genito-urinary system.

Stenosis of the Esophagus—Stenosis of the esophagus, or stricture, is a condition which occurs in any portion of the gullet and may have many causes, but it is usually organic in nature. At times the organic lesion, instead of originating within the esophagus proper, is found in a neighboring organ or tissue, and through pressure upon the esophagus produces a stricture effect. Such outside causes are found in the enlargements of the lymph glands of the chest associated with such affections as Hodgkin's disease, tuberculosis, inflammatory conditions, abscesses, tumors, and cysts. It also accompanies enlargements and dilatations of the heart or its large vessels, or of the thyroid gland, and certain lung affections.

When the organic lesion involves the gullet proper, the causes may have been the result of damage following the deliberate or accidental drinking of strong acids, alkalis, or other irritants, which resulted in severe damage to the gullet lining with the formation of scar tissue to a pronounced degree. Scar tissue may develop within the esophageal wall in the wake of any advanced inflammation or ulceration of its tissues, whether it originates in diseases such as diphtheria or syphilis, or following injuries, or in association with tumors which undergo destructive changes.

Tumors of the Esophagus—Tumors of the esophagus other than cancer occur from time to time. They may usually be regarded as *benign* in nature, yet they will sometimes produce severe symptoms, depending upon the degree to which they obstruct the gullet. Some of these growths are lipoma (fatty tumor), myoma (muscle tumor), fibroma (fibrous tissue growth), myxoma (mucoid tumor), polyps (pedicles or projections of mucosa, or outgrowths of the lining), and sarcoma (*malignant* form of connective tissue).

Carcinoma (Cancer) of the Esophagus—Carcinoma of the esophagus is a comparatively common condition, usually occurring in middle life and more frequently in males than in females. It is believed to owe its origin in many cases to irritation of the gullet lining; the irritation may be of a *mechanical*, a *chemical*, or a *thermal* nature, the second of which may explain its frequent occurrence in alcoholics. It usually occurs in the middle or lower third of the esophagus, and frequently involves and surrounds the entire wall of this organ and may extend a considerable distance. Two types of cancer are met with in the esophagus, the *scirrhous* or hard type, and the *medullary* or soft type.

Obstruction of the gullet, irrespective of the cause, has many common symptoms. In organic affections, however, complications may

develop which give rise to additional complaints or a prolongation of the common symptoms. In all early obstructions of the esophagus, there is usually a sensation of mild discomfort in the region of the sternum (breastbone), which, as time goes on, is replaced by definite difficulty in swallowing. In those cases where the food does not enter the stomach adequately, it is retained above the constriction level and after a time is either regurgitated in small quantities or completely eliminated through vomiting. In cases of food retention and stagnation, the breath is usually foul. The sensation of fullness and discomfort underneath the breastbone may become most distressing. In instances where certain nerves within the gullet wall or in its neighborhood become involved, the musculature of the gullet is virtually paralyzed and occasionally loss of speech follows involvement of the recurrent laryngeal nerve which controls this function. Liquid or semi-liquid food is usually swallowed with greater ease than is solid food. But there are exceptions to this rule. When the obstruction is due to ulceration or cancer, complications often arise in organs near by, and such symptoms as bleeding, violent coughing, and various manifestations of paralysis, depending upon which nervous structures are involved, may occur. When the obstruction is high up in the gullet, swallowing may be difficult, salivation may become increased, and breathing may also become a hardship.

At times a rare complication, *rupture of the gullet*, occurs suddenly after a heavy meal. This is attended by nausea, vomiting, and signs of general collapse, and is usually followed by death. Hemorrhage from the gullet also frequently accompanies esophageal obstructions, especially of the organic processes, and is treated as any case of hemorrhage should be, by efforts to stop the hemorrhages, general supportive treatment, and rest in bed. In occasional instances hemorrhage is due to varicose or dilated veins in the gullet wall, which break open. This venous enlargement occurs in persons who have a congestion of the esophageal veins, probably the result of back pressure as in heart and lung affections, diseases of the chest glands, and diseases of the liver.

Constant observation, especially through fluoroscopy and X-ray photography, should aid the physician in arriving at a correct diagnosis. He must differentiate between organic and functional disturbances, and should come to a reliable conclusion as to whether the condition is a cardiospasm of purely nervous origin, or one that is the result of organic nerve disease, tumor pressure, tumor involvement of the gullet proper, ulceration, or inflammation.

The treatment will assuredly depend upon the correct diagnosis.

Medication to control the symptoms is always essential, as are efforts to feed the patient in an endeavor to overcome malnutrition, dilating the stricture area with bougies or dilators where this procedure is permissible and no damage can be done, and, finally, resort to either X-ray or radium therapy or surgery where these measures appear to be indicated.

CHAPTER IX

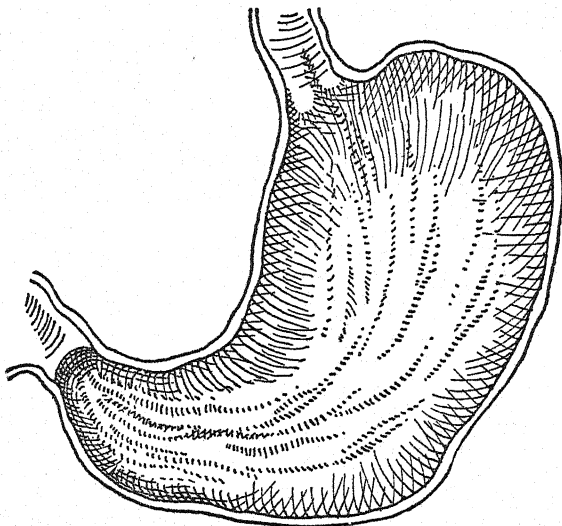
Diseases of the Stomach

Ulcer of the Stomach—Since so-called *stomach ulcer* is an ailment that frequently disturbs the mind of the average person, we shall give it first consideration in this chapter. It is important, in connection with the subject of ulcer, that the reader become acquainted with the fact that ulcer of the duodenum (uppermost small intestine) is actually not a stomach lesion although often regarded as such.

It is exceedingly difficult to state with certainty the cause of ulcer in any particular case, but many opinions have been expressed generally as to the actual primary cause and also regarding superinducing causes. The initial destructive change within the lining tissue of the stomach, which precedes actual ulcer development, is believed to result from a lowered local tissue resistance within a certain part of the stomach wall. This diminished resistance may result from irritations, congestions, or inflammations, from nervous influences producing spasm of the smaller arteries (arterioles), from toxic or poisonous influences, or from plugs of loosened tissue (emboli) or small blood clots (thrombi) which will invite tissue degeneration. This degenerating tissue is then exposed to further damage by the ever present digestive ferments of the stomach juice, as a result of which a true ulcer may develop. Under normal conditions no destruction of tissue or lowering of resistance occurs, hence there is no ulcer formation.

Some of the influences mentioned may have resulted from indiscretions in the diet, such as the taking of very hot or cold food, irritating spicy foods, food containing toxic elements (such as ptomaines), and the drinking or eating of irritating substances. Constant nervous tension, exasperation, forms of mental shock, and distress may through the nervous system cause spasm of some of the small blood vessels in the stomach wall. Infections of the body as in grippe, sore throat, and sinus catarrh may lead to local disturbances in some of the small blood vessels or tissue lining. In cases of arteriosclerosis (hardening of

the arteries), phlebitis (inflammation of the veins), and similar conditions, a possible manifestation of these respective diseases or their complications may arise in the stomach wall, thus inviting degeneration of tissue. It is also believed that certain people, debilitated by blood disease (anemia or chlorosis), diabetes, tuberculosis, or kidney



Normal appearance of the stomach lining.

ailments, show a tendency toward ulcer. Some students even believe that the condition is hereditary, but most authorities question this viewpoint.

The hypothesis that ulcer results from the presence of increased quantities of secretion or from a highly acid secretion is not acceptable to many authorities, but there is no doubt that these factors play a prominent part in aggravating an ulcer which has already developed, or in aiding other factors which are imminently concerned in the ulcer production.

Ulcer of the stomach occurs at almost any age from childhood on, but it usually affects individuals between the ages of puberty and middle life. It affects both sexes and people of all races. It is likely, however, to be more prevalent in persons of a high intellectual level who suffer considerably from mental strain. The author has occasion-

ally seen this disease in small children and in people in their late seventies.

Ulcer, as considered here, is the *chronic* (enduring) form, and not the acute (short-lived) form which simulates the canker sores in the mouth or on the tongue which disappear in a relatively short time. Chronic ulcer, however, can express itself as an acutely severe condition which requires considerable effort on the part of the doctor to ameliorate. Of the enduring form of ulcer there are two general varieties: first, the *superficial* or so-called *simple ulcer* which is not deep; and, second, the *deeper ulcer*, known as *ulcer penetrans*, which may vary in its depth of penetration through the stomach wall, from within to its outer surface.

An ulcer which, though deep, shows signs of healing is spoken of as a *callous ulcer*. When an ulcer in its deep penetration involves a blood vessel (either artery or vein), bleeding may occur, in variable degree, and the condition is referred to as a *bleeding ulcer*. When deep ulcers heal, with scar tissue formation, they may exhibit contraction of the tissue about the ulcer area and thus cause deformities of the stomach outline, and, depending upon the particular part of the organ involved, may even cause obstruction or dilatation and other defects in stomach function. In rare instances an ulcer perforates into the abdominal cavity, causing either a local or general peritonitis (infection of the peritoneum or protective layers of tissue lining the abdomen). At times this complication is followed by the development of adhesions (formed from the gluey secretion elaborated by the peritoneum), which attach themselves to neighboring organs and may or may not give rise to distress, depending upon the organs involved and the extent of the disability occasioned by their presence.

Perforation of an ulcer into another organ, such as the colon, the gall bladder, or even the chest cavity, may result in the formation of a *fistula*; this usually requires surgery. Ulcer may occur in any part of the stomach wall, high up, midway, or low down, and on any part of its circumference. It is most commonly seen on the *lesser curvature* (right border) of the stomach and low down in the pylorus portion. The superficial ulcers may be multiple in number, but the deeper ulcers are usually single in occurrence.

SYMPTOMS—Ulcer of the stomach presents symptoms of varying forms and degrees. Evidence of healed ulcers has been found at autopsy in persons who, during life, had not complained of stomach disturbances to any notable extent. Some individuals who have had no symptoms referable to the stomach or the bowels may suddenly

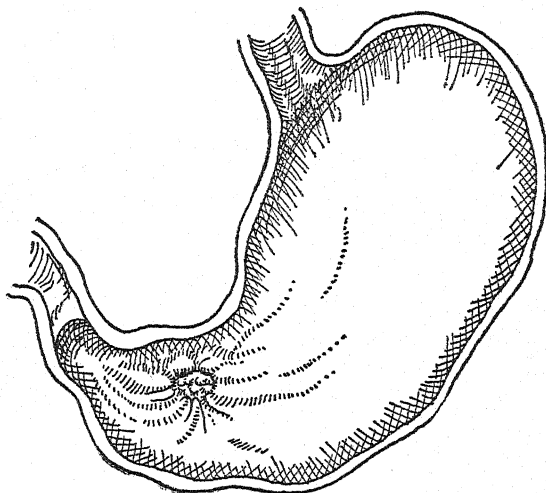
manifest illness because of ulcer perforation or ulcer hemorrhage (bleeding), indicating that the process may have existed for some time without the production of digestive symptoms. On the other hand, symptoms do occur in most cases, but they vary from slight manifestations of indigestion to severe distress. Symptoms of indigestion include belching, nausea, vomiting, bloating, regurgitation of food or sour material, and varying degrees of pain.

The *pain* may present itself in the form of heaviness, dullness, and mild or severe manifestations. It is local or diffuse (spreading) and usually located in the epigastrium (upper mid-abdomen near the lower tip of the breastbone). It may occur during meals or after meals, either immediately or hours later, but most frequently it occurs from one-half to one hour after meals, when digestion is presumed to be at its height and the stomach is active and often irritable. The pain is frequently localized in the epigastrium or "pit of the stomach," but at times it radiates through to the back or travels around the sides to the back; it may also be felt below in the abdomen or in the chest, especially over the heart area, and at times in the arms. The pain varies in duration as well as in intensity.

Vomiting, though not always present, frequently occurs in cases of stomach ulcer; this is usually due to increased irritability of the lower portion of the stomach, so-called pylorospasm (spastic contraction of the muscular tissue comprising the pyloric end, or outlet, of the stomach). It occurs usually after eating, when digestion has reached a high point, and most frequently after eating a heavy meal.

The vomitus (material ejected) is highly acid as a rule, and consists either of liquid stomach secretion alone or an admixture of this with food previously eaten. Occasionally *blood* in considerable quantity is noted in the vomitus; in that case it should be determined whether this is due to bleeding from the ulcer area or from some other point, as in rupture of a small blood vessel in the throat, bronchi, lungs, or gullet. If evidence definitely precludes the coughing up of blood from the respiratory tract, the blood most likely comes from the gullet or stomach. Bleeding from ulcer may continue for a short or longer period of time, and the quantity varies from sudden large hemorrhages to prolonged smaller bleedings. When considerable blood has been lost the patient may experience a sudden sensation of faintness or dizziness and note black specks before the eyes, or may even collapse and become unconscious. The vomitus may vary in color from red to coffee brown or even black, depending upon the amount of bleeding and the chemical effect of the stomach juice upon the blood. When con-

siderable blood is found in the vomitus, it will also be found in the stools, which appear very dark brown or black in color. When the stool appears to be normal in color, the blood must be sought for by a chemical test often referred to as the *occult blood test*. In many in-



An ulcer at the lower pole of the stomach.

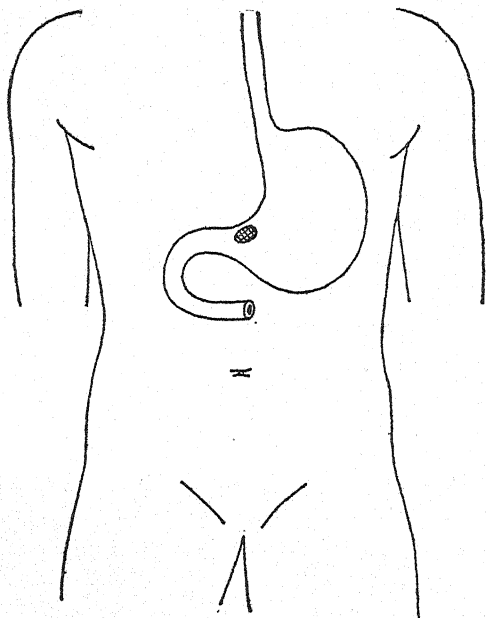
stances where vomiting seldom or never occurs, the only means of detecting the presence of bleeding is through the examination of the stool or fecal excrement for occult (hidden) blood.

When bleeding of an ulcer is suspected, further proof of its existence may be brought out by an examination of the patient's blood (blood count, hemoglobin estimate) for the condition known as *secondary anemia*. When the anemia resulting from hemorrhage is pronounced, such symptoms and signs as dizziness, buzzing in the ears, specks before the eyes, sighing, thirst, headaches, pallor of the skin, lips, and conjunctiva (red lining) of the eyes, and other general evidence may be noted.

Through the various stomach tests already described in another chapter, evidence of the existence of *hypersecretion* (secretion of excessive quantity of stomach juice), *hyperacidity* (increased degree of acid quality), *reduced* or *excessive mucus elaboration*, and usually an *increase in ferment* (pepsin or rennin) manufacture is presented as an indication of stomach irritability. By means of the stomach tube a

delay in the evacuation of contents from the stomach is at times ascertained; this is especially useful when hindrance to elimination takes place at the stomach outlet (pylorus). Such an obstruction may result from a spasm at this outlet, from a contraction scar occurring during the healing of ulcer, or from adhesions around the outlet.

The X-ray film and the fluoroscope will further enlighten the examiner and perhaps confirm information acquired through other



Dark spot shows the frequent location of ulcer along the lesser curvature (inner border) at the lower pole of the stomach.

means. Such evidence of irritability as *hypertonus* (increased stomach muscle tone) in early uncomplicated ulcer, *spasm* at various levels of the stomach, *increased peristalsis* (exaggerated expression of muscle contraction) recognized by an increased number of waves of contraction or an increase in the depth of these contraction waves, and in some instances a *delay* in the evacuation of the stomach contents because of a sustained spasm of the stomach outlet are significant findings. In some cases direct evidence of an ulcer is suggested by a *defect*

in the border outline due to ulcer scar contraction or localized spasms in the stomach wall, and in rare cases by a *diverticulum* (pocket), the result of ulcer perforation associated with localized peritonitis. When *obstruction* at the outlet of the stomach exists, the X-ray film may reveal the retention of barium contents within the stomach for at least six hours or more.

The treatment should, if possible, be of a medical nature, and the patient must be under control for months or years. In acute cases where great pain or bleeding occurs, rest in bed may be advisable for weeks or months. At first a limited liquid or semi-liquid diet is usually employed; later, with improvement, a more solid diet of bland and non-irritating foods should be substituted. Anti-spasmodic medication or sedatives may be required for a period of time to control the spasm or pain, as well as various alkali or neutralizing preparations to reduce the quality and quantity of the stomach secretion. In severe cases there is an additional mode of treatment which consists of injecting a medicated solution into the veins at regular intervals. The outlook will depend upon the extent of the ulcer development and the location of the lesion, as well as upon the complications, such as bleeding or obstruction.

Where pyloric obstruction has developed, frequent stomach lavages (washings) are strongly advocated. In cases which have lasted for years in spite of excellent medical care, or where the threat of repeated bleedings exists, surgery may have to be considered as a last resort, but this is not the rule. Patience and persistent indulgence in discretion over a period of years may be the price a person suffering from ulcer will be forced to pay to attain a complete cure or decided improvement in his condition.

Gastric Erosions—Often symptoms which are so troublesome as to suggest the existence of an ulcer will occur in some people, yet upon investigation the examiner feels that no true ulcer exists. Thorough study may strongly intimate that these individuals are suffering from the condition known as *erosions*, which implies the manifestation of small areas of tissue denudation within the stomach lining, simulating the canker sores frequently seen in the mouth.

The eroded areas may be *acute* (short-lived) or *chronic* (of longer duration). The exact reason for their occurrence is not known, but it is possible that the same causes which produce ulcer may operate here. Such indiscretions as eating improper foods, spices, and condiments or drinking liquor often play a part in the production of this ailment. It may occur in cases of heart and lung disease, in arteriosclerosis, in in-

fections, in the wake of a persisting stomach catarrh, and as an expression of allergy.

The symptoms simulate those of stomach ulcer and will vary in accordance with the number of lesions and their exact location in the stomach. Pain in varying degree, more or less confined to the upper mid-abdomen, and usually occurring from fifteen minutes to one hour after meals is not uncommon. Other symptoms of irritability such as reduced appetite, belching, fullness, and vomiting—in fact, such symptoms as frequently characterize ulcer of the stomach—may be experienced. At times slight quantities of blood are seen in the vomitus because of bleeding from the erosion.

A thorough acquaintance with the case will lead the physician to regard the condition as one of erosion rather than of ulcer. An X-ray examination which reveals no definite indication of ulcer, despite the persistence of the condition, occasionally impels further study by stomach tests, intragastric photography, or gastroscopy. The erosions are frequently recognized by the latter methods.

The treatment, as in ulcer of the stomach, requires proper diet and medication which aims at healing the erosions and relieving the symptoms. Sometimes measures to improve the general condition of the patient, as well as frequent stomach washings, are warranted. When allergic causes are suspected, attention in this direction should not be neglected.

Gastritis—The disease referred to as gastritis is actually a *catarrh of the stomach lining* and not, as many persons often believe, a disturbance of the stomach associated merely with the *production and belching of gas*. The word gastritis, derived from the Latin, means inflammation of the *gastrum* (stomach). Gastritis occurs in many stages from a very mild to a pronounced form, and also manifests itself either as an *acute* or as a *chronic* process. The acute and chronic processes may have the same variety of causes, and the acute form often eventuates in the chronic form.

Some of the predisposing causes of the milder grades of gastritis are indiscretions in the diet, such as the eating of rich, coarse, spicy, and sour foods and the ingestion of considerable liquor or irritating beverages and toxic foods like stale fish or meat. The more severe forms usually follow the drinking of powerful acids, alkalies, or poisons. The toxic elements in decomposed or tainted meats and fish may act as a severe chemical irritant upon the stomach mucosa (lining). Some views intimate that the condition may follow in people predisposed to

it who have been exposed to extreme cold or who have had a severe cold or la grippe.

The *chronic* condition may occur in individuals who have for years eaten irritating foods and drunk large quantities of strong liquor. Persons who have had poor teeth or lack of teeth for a long time may have improperly prepared their foods for further digestion in the stomach, and in consequence the stomach has sustained considerable irritation. Infected teeth or gums contribute to the conveyance of infected food into the stomach and thus invite infection of the stomach wall. Excessive smoking and swallowing of tobacco juice may incite a stomach catarrh. The chronic form of gastritis also occurs in association with other ailments such as gall-bladder and gall-duct diseases, liver disturbances, and affections of the heart, lungs, kidneys, and intestinal tract. Often this ailment complicates or accompanies other general or constitutional conditions such as anemia, sprue, malaria, and cancer. The degree of inflammation will vary from a mild to a severe form, and the stomach lining will suffer accordingly.

The symptoms of the disease will depend upon the severity of the catarrh. Loss of appetite, sensations of fullness or pain in the epigastrium (pit of the stomach), disturbed taste, belching, nausea, vomiting, and abdominal colic (belly-ache) may be present separately or in combination. Patients often crave spicy foods to stimulate an appetite that is either non-existent or very poor. Thirst is a common occurrence, and the mouth is usually dry. The breath is often foul and the taste is disturbed. Those suffering from chronic forms of the disease may have attacks of morning vomiting. Often spasms of the gullet, inlet, or stomach body proper may manifest themselves. In advanced catarrh, areas of bleeding may complicate the picture and the condition may be attended by the vomiting of blood. Examination of the abdomen often evidences pronounced tenderness over the epigastrium (pit of the stomach) or upper right or left regions.

The *acute* form of gastritis, when the result of some mild irritation, is simple and runs a short course of one or two days, but when it is severe it may continue for a longer period of time before a cure is effected.

The *chronic* forms of gastritis will vary in severity and present symptoms of varying degree. In mild cases the individual may complain only of poor appetite and slight distress in the pit of the stomach, whereas in the more severe cases he will also register such symptoms as severe pain, nausea, and vomiting. At times diarrhea or constipation will also be experienced.

In rare instances, in which infection is the basic cause, a form of stomach catarrh known as *phlegmonous gastritis* occurs. This may result from a direct infection of the stomach wall through the swallowing of infective foods, or through direct extension from above as in cases of sore throat. It may also follow as the result of a spread of the disease from some other source through the blood stream. Sometimes it will complicate a pre-existing catarrh, ulcer, or growth within the stomach. The condition is usually attended by pus formation, and may even go so far as to penetrate through the stomach wall and produce a peritonitis (inflammation of the peritoneum or lining of the abdomen), thus bringing about a grave condition. When the infection is virulent, it can spread to adjoining organs. The symptoms then are severe and include such general manifestations as fever, headache, weakness, and aching in the body and limbs. Many of these acute cases develop into a chronic form of the disease and the patients eventually recover.

When the complaint continues for a long time, it may be necessary to study the stomach contents after giving the patient a *test breakfast*. Too much secretion and too much acidity suggest a line of treatment to combat these manifestations. On the other hand, a reduced secretion or a lowered acidity indicates the employment of an entirely different form of treatment. Whether the stomach empties too quickly or too slowly may also be ascertained by this stomach test. Frequently an X-ray examination is made to enhance the physician's knowledge of the case, and in rare instances a direct examination of the stomach wall through the gastroscope or by intragastric photography is attempted.

The treatment of gastritis will depend upon the type dealt with, and it is important to remove the cause as far as possible. Improper and irritating foods and stimulating beverages should be interdicted. Poor teeth should be attended to, and defective chewing should be corrected. Where the general condition does not measure up to par, it must be improved and constitutional treatment instituted to correct any defections. The diet should consist of mild liquids during the first few days, until the signs of stomach irritability have diminished; then a gradual addition of semi-solid or solid non-irritating or bland foods is made, as time goes on, and the symptoms improve.

In cases which result from the taking of poison, antidotes should be given to counteract the effect; if necessary, lavage or washing of the stomach may be warranted. Distressing symptoms such as nausea, vomiting, diarrhea, and constipation require special attention. When the stomach test evidences too much acid, the administration of alkali

medication may prove of value; on the other hand, when a pronounced reduction in acid is evident, acid medication is often utilized. For distress or pain, either anti-spasmodic or sedative treatment is usually employed. In a serious infective condition like phlegmonous gastritis, such new preparations as the sulfa drugs or penicillin may prove of value; in some cases—those which survive the acute onslaughts of the disease—surgery may occasionally be required.

Perigastritis—This condition is an inflammation which involves the *outer coat of the stomach*. It often follows when the stomach wall has been penetrated by a deeply progressive ulcer, or it may be the result of the spread of inflammation to the outer surface of the stomach from another organ near by. The inflammation may not confine itself to the stomach alone, but may also involve other organs such as the duodenum, liver, gall bladder, pancreas, and intestines. The symptoms naturally will depend upon the organs involved and upon the nature and extension of the adhesions formed in this process. Adhesions are bands of connective tissue formed from the gluey substance secreted by the lining of the abdomen (peritoneum) during the process of inflammation or irritation. The bands are usually short and broad when linking near-by organs together, but long and thin when linking organs that are farther apart. When these adhesions contract they often give rise to disturbances in the organs to which they are attached. They may deform the appearance of an organ, produce narrowing in some portion of a hollow organ, and even cause obstruction to the emptying of an organ. This may happen to the stomach in perigastritis, and to other organs to which the adhesions are attached. The X-ray film will often reveal many changes in the appearance or function of the stomach in such instances.

The symptoms may result from a diseased condition (as in ulcer or gall-bladder disease) which originally invited the development of perigastritis, as well as from added disturbances created by the adhesions. Often patients will state that they had recovered from a previous ulcer or gall-bladder ailment only to have a return of symptoms a year or more later. The recurring symptoms, however, are not exactly of the same nature as they were. The main complaint now is pain confined to a site corresponding to the adhesion area. The abdomen may be quite tender at certain spots and feel thickened. X-ray photography and fluoroscopy of the stomach aid considerably in the diagnosis.

The treatment will depend upon the underlying cause, which greatly influences the symptoms. Medical measures for ulcer or gall-bladder disease may be required. At times only surgery will correct the fixed

mechanical deformities that are fundamentally behind the complaint.

Functional Disturbances—Functional disturbance of the stomach is the most common form of ailment to affect this organ. By this form of disease is meant a condition to which *no definite organic basis* can be ascribed. The manifestations of functional disturbance are many and varied, and the causes may likewise be numerous. Under this heading are included such conditions as hyperacidity (increase in the acidity of the stomach secretion), hypersecretion (increase in the quantity of stomach juice secreted), gastromyorrhea (increase in the secretion of mucus), some forms of anacidity (lack of proper elaboration of acid in the stomach juice), nervous dyspepsia, often referred to as neurasthenia gastrica (believed to result from psychic disturbances), sensory disorders of the stomach, and a form of gastralgia (neuralgia of the stomach) which presumably is not connected with an organic cause.

Hyperacidity—Hyperacidity is usually found in young persons, especially those undergoing great mental strain. It may also follow from dietary indiscretions, excessive smoking, or the drinking of liquor, and may occur in persons who have a strong nervous tendency. In these cases the stomach secretion, after a test breakfast, reveals a rather high degree of acidity—anywhere from 70 to 120 or more degrees of total acid.

The sufferer will usually complain of such symptoms as heartburn, sour regurgitation, and pain after eating; the pain manifests itself in the pit of the stomach, with occasional radiation to the back or shoulders. Mental irritation will aggravate the symptoms. Starchy foods are often not well tolerated. The general condition of the patient is usually good and X-ray studies reveal either no abnormality or merely some evidence of stomach and intestinal irritability.

Dietary treatment and correction of the cause, as far as possible, usually bring about a rapid recovery.

Hypersecretion or Gastrosuccorrhea—This manifests itself in various forms: (1) as an acute attack at periodic intervals; (2) as a phenomenon associated with digestion only; and (3) as a continuous manifestation over a long period of time. This condition frequently occurs in people who are nervous or sensitive, and is characterized by the elaboration of an increased quantity of gastric secretion.

The first type will, as a rule, occur *suddenly* and rather violently in individuals who are in apparently good health. The symptoms are usually pain in the epigastrium (pit of the stomach), regurgitation of sour material from the stomach into the mouth, belching, nausea, and

vomiting. The quantity vomited is considerable. Frequently the patient has a headache and is weak during the attack. The attack may last from a few hours to a few days, and is often regarded as migraine when headaches are present. Vomiting often gives great relief.

The second type occurs immediately after eating or during the *period of digestion*, and simulates very closely the first form as to symptom expression, except that vomiting is not usual. Pain in the epigastrium may be prominent. Many of these patients also suffer from constipation.

The third type, *continuous hypersecretion*, is characterized by a variety of symptoms of indigestion, such as heartburn, fullness in the epigastrium, belching, regurgitation, nausea, and vomiting; but one of the outstanding complaints is pain in the epigastrium, which varies from a mild distress to severe pain or even cramps. The pain frequently occurs during the late hours after eating and during the night, and the condition is frequently confused with duodenal ulcer. The pain is believed to be due to spasm of the pylorus (stomach outlet) presumably of a nervous origin. The stomach, in this condition, secretes continuously during the period of digestion and between digestive periods. Often the symptoms are so distressing as to necessitate the emptying of the stomach for relief. Some individuals accomplish this by inducing vomiting through irritating the throat with the finger, thus initiating the vomiting reflex; or it may be effected by the physician through the use of a stomach tube. The appetite is usually good, but patients fear to eat because of the distress created. Vomiting, when it occurs, is usually associated with the bringing up of large quantities of fluid stomach contents, at first containing food previously eaten, and later including watery or viscid material occasionally bile-stained.

The stomach tests will reveal the presence of large amounts of secretion with a normal or high acidity range, and the X-ray examination may reveal some irritation or spasm of the stomach outlet. Thorough studies should be made in every case of long standing in order to rule out organic ailments such as ulcer, stomach catarrh, and gall-bladder disease.

The treatment of these various forms of hypersecretion depends upon the severity of the symptoms and the nervous state of the individual; primarily it embodies rest—physical and mental. The severe cases with pain may require the use of anti-spasmodics and sedative medication. Food should be limited to few and simple liquids at the beginning, with the gradual addition of bland solid foods as time goes on. Such foods include milk, thin cereals, weak tea, simple broths,

toast, barley water and the like. Alkali medication to neutralize the excessive stomach acidity is usually prescribed. Observation by a physician over a period of time is recommended.

Gastromyorrhea—Gastromyorrhea is a condition characterized by a decided increase in the secretion of *mucus* (slime) by the glands in the wall of the stomach. Ordinarily the stomach juice contains small quantities of mucus but in this affection it is notably increased. There are two forms of the disease, *intermittent* and *continuous*.

The *intermittent* form occurs less frequently than the other, and manifests itself as a rule in the early morning, when the patient will vomit large amounts of mucus. The attack occurs suddenly, and after a few hours or days ceases suddenly. The symptoms are chiefly nausea, headache, epigastric discomfort, and vomiting, with general weakness in the wake of the vomiting process. The attacks are probably the result of dietary indiscretions or of some allergic influence, and may occur at intervals—long or short.

The *continuous* form is more common, but with this the patient is usually not so acutely ill. The symptoms are referable to the stomach in the form of epigastric discomfort, nausea, vomiting less violent and less frequent than in the other form, and general weakness. The vomitus will exhibit an extraordinarily large amount of mucus, which comes from the mucous glands of the stomach wall. The cause is frequently believed to have a nervous foundation, but it is important in certain instances for the physician to bear in mind a possible organic basis, such as gall-bladder disease or ulcer. Stomach tests will reveal large quantities of mucus in the stomach, due to the oversecretion of the mucous glands.

The treatment is mainly symptomatic. Pain and nausea are prominent symptoms to be attended to. The diet should be simple, bland, and non-irritating. Lavage (washing) of the stomach at frequent intervals with weak sodium bicarbonate solution will cleanse the stomach and relieve untoward symptoms. At times anti-spasmodic and sedative medication is indicated.

Anacidity—Anacidity implies an *absence of acid* in the stomach secretion. This condition may be purely functional or nervous in origin, and should not be confused with achylia gastrica, which usually has an organic basis. This functional form may owe its establishment to some nervous or psychic disturbance, in consequence of which the nerves controlling secretion have been affected. Like the acid, the stomach ferments also may be reduced or absent. It is important that the physician observe the patient carefully and make various studies of the

stomach contents, as well as X-ray investigations, to eliminate the possibility of overlooking an organic ailment as the primary cause. The symptoms ordinarily include mild distress in the epigastrium, occasional nausea, loss of appetite, and bloating in the abdomen, depending upon the duration and severity of the process.

The treatment requires a proper diet consisting of bland food and well-mashed or chopped meats and vegetables. The administration of dilute hydrochloric acid and pepsin, or a preparation made from the mucosa of the stomach (tripe), may prove beneficial. Symptoms such as nausea or loss of appetite sometimes require special medication.

Achylia Gastrica—Achylia gastrica is a condition not so infrequent as many believe. The ailment already referred to as an acidity should not be confused with it, for although they both have many symptoms in common they are basically quite different. In an acidity, which is characterized by a profound lowering or absence of acidity, the ferments of the stomach may be present in normal strength, whereas in achylia not only is the *acid* reduced or absent but the *ferments* are also decidedly diminished or absent.

Achylia is believed by certain authorities to have a purely functional origin in some cases, but in most instances it is regarded as due to some *organic* factor. It is not uncommon to find this condition associated with such general debilitating ailments as pernicious anemia, diabetes, thyroid disease, and tuberculosis. It may follow in the wake of a previous gastritis (stomach catarrh) or gall-bladder and liver affections. In rare instances it is of congenital origin. According to the more common belief, the lining of the stomach loses its power to secrete ferments and acid, in the so-called functional cases, because of a depressive nervous influence and in the organic cases because of atrophy (degenerative changes) of the mucosa, especially its secreting portions.

Often individuals who have this condition are unaware of its existence, because they have not had any symptoms referable to the stomach or bowels, but once they begin to complain of some form of indigestion it is easily recognized. The physician usually administers a test breakfast, and this reveals the condition. The symptoms are almost identical with those mentioned above under an acidity. They are: distress in the epigastrium, loss of appetite, heartburn, belching, constipation, or diarrhea. In advanced achylia, where ferment elaboration is almost lost, diarrhea often occurs and may cause considerable discomfort to the patient. This is spoken of as gastrogenous diarrhea (looseness of the bowels, of stomach origin). This is believed to be due to the rapid emptying of the stomach which usually characterizes this ail-

ment, plus the irritating effect upon the intestine created by the undigested food elements. Where a diminished quantity of stomach acid and ferments is produced, a poor digestion will occur, hence the train of symptoms mentioned above. Consequently poor digestion results in defective preparation of the food for absorption, and lowered nutrition is the result. Anemia and loss of weight and strength are common characteristics of this ailment. Fortunately in many cases it is believed that the intestinal lining performs vicariously (makes up for the loss of stomach digestion) in the digestion of some of these foods.

The treatment usually demands the substitution of those products which the stomach lacks, such as dilute hydrochloric acid to replace the lost acid, and pepsin to replace the lost ferment. A stomachic tonic is at times employed to restore appetite, and a pancreatic substance to aid in intestinal digestion. If the diarrhea is severe, astringents such as bismuth or tannigen may be needed for a time. The food must be bland, soft, and puréed or mashed as much as possible. Meats, when allowed, should be chopped, well-cooked and thoroughly chewed. Chicken, lamb, and fish are better than red meats. Dairy products and cereals are agreeable foods. The administration of liver and vitamins may be necessary in many cases, and the general nervous and psychic state of the individual must be bolstered to a proper level. The outstanding symptoms, whatever they are, should be given earnest consideration.

Neurasthenia Gastrica—*Neurasthenia gastrica*, or *nervous dyspepsia*, is believed to originate chiefly from *psychic* (mental) disturbances. A thorough history will usually make this fact clear. Symptoms ordinarily include nausea, belching, heartburn, vomiting, and a lump in the lower throat or chest underneath the breastbone. Often the victims of this ailment will feel entirely well during periods of great trial, but as soon as calm prevails they begin to concentrate upon the condition of their stomach and the symptoms again occur. Many of these nervous people have fear of cancer and brood over this. As a result they develop nervous disturbances in the stomach which affect one or more of the functions of this organ. Such patients are often referred to as hypochondriacs.

The symptoms will vary to a certain extent in different people. Some will complain of a loss of appetite of varying degree. Others will also complain of belching, nausea, and even vomiting. Some have either heartburn, heaviness, or weakness in the epigastrium, depending upon the nature of the stomach irritability. In addition, these individuals usually have symptoms referable to the general nervous system, such

as dizziness, headaches, pressure sensations in the head and body, flushes, and chilliness.

Examination may reveal no tenderness or other sign of active disease within the abdomen. The weight often is reduced because of abstinence from food for many weeks. Otherwise the general physical condition may be normal. In doubtful cases it is important to resort to X-ray studies to warrant against overlooking an organic condition.

The treatment requires, first of all, that a psychological impression be created in the patient's mind that a thorough examination has been made and that everything necessary is being done. Assurance must be given that no serious ailment affects the patient. Suggestions should be made as to steps which will contribute to the patient's general welfare, and as to methods of procedure which will improve the nervous condition of the patient, such as physical and mental rest, moderate exercise, massage, and environmental changes. The diet should be as bland as possible, and should avoid irritating, spicy foods. Only such medication as the disturbing symptoms require should be prescribed. A reasonably co-operative patient should make a splendid recovery.

Gastralgia—Gastralgia is a condition characterized by pain, of varying degree, which is presumed to originate in the stomach. When it occurs in the form of a cramp under the breastbone it is regarded as a *cardiospasm* (spasm of the inlet); when it occurs at the right border of the epigastrium it is often the result of *pylorospasm* (spasm of the outlet). Occasionally a severe, cramplike pain in the pit of the stomach may be due to *gastrospasm* (spasm of the body of the stomach). Gastralgia is looked upon as a *neuralgia of the stomach*, purely functional and not organic in origin. It is important, when attacks of spasm occur, to look also for an organic cause such as ulcer, gall-tract disease, or chronic appendicitis.

The treatment is chiefly symptomatic, and includes total abstinence from food at the beginning as well as curtailment of irritating substances for a week or longer.

Sensory Disorders—Some of the disorders which can be ascribed to the sensory nerves in the stomach are loss of appetite (anorexia), increased appetite (bulimia), and a craving for foods which ordinarily would not appeal to the individual (parorexia). These *disturbances in appetite* are believed to be purely functional and occur as a rule in nervous persons who have been under great mental strain or who tend toward hysteria. Individuals who evidence anemia or some blood affection may complain of similar symptoms. *Nausea* also presents itself in some people as a functional disturbance not related to organic

disease. This may or may not be associated with a disturbed appetite. These disorders probably originate in sensitive nerves within the stomach lining or are involved in some psychoneurotic dysfunction (disturbance of mind and nervous system). Of course, an organic background must first be ruled out.

The treatment is symptomatic (according to symptoms) and may require nerve sedatives, anodynes, mental encouragement, stimulants for the appetite or depressants in that direction where necessary, environmental change, and the avoidance of coarse, irritating, or spicy foods and adherence to simple, bland foods.

Gastroptosis—Gastroptosis, ordinarily called *dropped stomach* but in reality a stomach placed low from birth, may cause considerable distress in some people. Often this stomach placement is associated with a similarly low placement of the intestines, kidneys, or other abdominal organs. When the *ptosis* (lowness or fallen condition) of the stomach is pronounced, the entire organ usually has assumed a lower than normal position, but there are instances in which only a portion of the stomach is ptosed (dropped or low). When the outlet (pylorus) and inlet (cardia) are lower than normal, the entire body of the stomach is necessarily low; but when these parts are fixed in their normal positions and the body of the stomach is low, the stomach is said to be only partially ptosed. When these ends of the stomach are ptosed, the cause is believed due to a stretching or loss of tone of the ligaments which ordinarily fix these points at a relatively high level in the abdomen.

Usually the person who presents the condition of gastroptosis has an inherent congenital disposition toward the development of a *vertical or elongated stomach* because of the so-called *habitus asthenicus* which characterizes him. Many people, however, who have such a vertical and elongated stomach do not complain of illness or symptoms of any kind. They are nevertheless potential victims who may, upon indiscretions in diet or after great mental strain, care, or worry, develop stomach symptoms.

These individuals, after violent physical exertion, unduly strenuous exercise, or severe illnesses attended by loss of weight, may also develop symptoms of stomach disorder because they have overstrained the ligaments attached to the stomach and in consequence of this the organ has descended to a lower level in the abdomen.

As stated above, individuals predisposed to the development of gastroptosis are usually those who have the type of body build characterized by a long, narrow chest and a narrow abdomen; this may be

either congenital, or the result of poor body development occasioned by poor hygiene, inadequate nutrition, or debilitating ailments such as tuberculosis and chronic stomach and bowel disorders. At times, following childbirth, women will develop a ptosis of the stomach as a result of loss of abdominal tone and because the ligaments which support the various abdominal organs have lost their tone quality.

Symptoms of which gastropototic patients complain will vary from insignificant to well-pronounced complaints. Severe symptoms may embody one or more manifestations, such as pain in the epigastrium, fullness or pressure in this area, belching, nausea, and vomiting. When the tone of the stomach musculature is deficient in cases of ptosis, the food will lie in the lowermost pole of the stomach for a long period of time and produce additional symptoms characteristic of stasis or accumulation within the stomach. This is not an uncommon complication.

In these cases a stomach test may ordinarily show no abnormality, but there are times when too much secretion or a too highly acid juice is elaborated and then other symptoms or an aggravation of existent symptoms may be encountered. X-ray films will exhibit a low-placed stomach as usually vertical in position. If atony exists to any extent, the stomach may be quite low in the pelvis. In pronounced ptosis the stomach outlet is at a low level. In some cases the outlet is held up by its ligamentous attachment and the stomach is only partly ptosed. Occasionally kinking of the stomach outlet or of the duodenum may occur because of the fixation of the ligaments attached to these parts, and symptoms of a mechanical nature (obstruction) may arise. X-ray photography will often reveal a ptosis of other organs in the abdomen, such as the small intestine, the large intestine, and the kidneys, especially the right kidney.

The abdomen, upon physical examination, usually presents a long, flat surface, and the *pulsation of the abdominal aorta* (large artery leading off from the heart) may be noticeable because it is exposed and not shielded by the stomach. The stomach is readily palpated in the abdomen below the umbilicus (navel) and as a rule is found to be dilated and distended. The area comprising the epigastrium is tender because the abdominal nerve plexuses (nerve-center groups) are exposed.

Treatment involves attention not only to symptoms, but also to the establishment of a proper diet consisting of bland food and reduced quantities of fluid. The proper action of bowels should be assured. A low abdominal supporter is indicated in nearly all cases. Persons

who complain of severe indigestion may require special medication. If the condition warrants, alkalies and anti-spasmodics are prescribed. General tonic therapy and attention to the nervous status of the case are often necessary. Physiotherapy is indicated at times, and psychological control of the patient is often essential. Gastric lavage may prove highly beneficial in cases associated with a delay in stomach emptying. The wearing of high, tight corsets should be condemned, because this practice tends to aggravate or exaggerate already existing symptoms by forcing the contents of the abdomen downward toward the pelvis. Massage of the abdomen and moderate exercises of this region also benefit many cases. Surgery is rarely advised except in extreme cases when all medical measures seem to fail in their objectives.

Gastric Atony—Gastric atony implies the *loss of stomach tone*, a condition which manifests itself in varying degrees from a mild to a very severe grade. It also occurs in two forms, the *acute* and the *chronic*.

The *acute* form usually develops *suddenly*, and frequently occurs in persons who have overeaten after having fasted for a period of time or suffered considerable physical or mental strain. People who have suffered from a severe debilitating ailment, such as pneumonia, typhoid, or tuberculosis, may also encounter this experience. Occasionally it occurs in people who, a short time before eating heartily, have been given a general anesthetic. It is believed to be due to a disturbance of the *neuro-muscular* mechanism (the nerves supplying the musculature of the stomach wall), as a result of which the muscles lose their tone quality and the stomach wall relaxes. The stomach appears dilated and is unable to empty itself. In occasional instances this results from a mechanical obstruction created by compression of the vessels about the duodenum. This form of atony is often referred to as acute dilatation of the stomach.

The *chronic* form of gastric atony does not manifest itself suddenly but occurs as a process of *long duration*. It is either congenital in origin, or acquired gradually over a period of time. The musculature of the stomach is believed to undergo loss of tone through gradual stretching or weakening, and as a result is unable to contract properly and empty itself. Most authorities feel that the victim must have had a potential *neuro-muscular* disturbance to begin with, probably *congenital*, to which other factors contributed in producing an advanced form of atony.

The symptoms of the acute form of atony are usually severe, and may

last from one to two weeks or more. Symptoms consist of acute colicky pain in the upper mid-abdomen, nausea, vomiting, and signs of general collapse. The abdomen becomes greatly distended in the upper middle part, because of stomach dilatation. Palpation of the abdomen reveals an accumulation of gas and fluid in the stomach, as indicated by the succussion splashes (splashing noises produced by tapping the abdomen vigorously and due to the presence of increased air and fluid in the stomach). Because of a loss of propulsive power in the stomach muscles, plus a possible hindrance to evacuation at the outlet, the food and secretions accumulate within the stomach.

The treatment of this acute form usually involves symptomatic consideration, such as attempts at overcoming collapse and shock. In addition, the stomach should be emptied through a stomach tube, and if possible lavaged. Food in the form of a salt-and-sugar solution should be administered by hypodermoclysis or intravenously for the first twenty-four to forty-eight hours, until decided improvement has occurred. At times rectal feeding is also employed. Feeding by the mouth is instituted slowly, in small quantities, over a long period of time. Other tonic measures if indicated should be utilized.

The symptoms of the chronic form vary from a mild to a rather severe degree, depending upon the factors involved in the production of this condition. Some cases exist for years with abdominal and X-ray evidence of an enlarged atonic stomach, with mild disturbances in stomach emptying but little if any subjective symptomatology. On the other hand, some patients complain of aggravated forms of indigestion presenting pain, fullness, nausea, vomiting, and definite interference with stomach emptying. The last of these is recognized through test-breakfast and X-ray studies. Upon palpation the abdominal examination may reveal a large, distended stomach with succussion noises as in the acute form. This condition may be primarily a neuro-muscular disorder, but there are times when stomach atony of this type complicates other diseases such as ulcer, gall-bladder affections, adhesions about the stomach outlet, pressure of adhesions about the duodenum and cancer near the stomach outlet.

The treatment will aim at removing the underlying cause, if this is determined, and correcting superinducing or associated conditions. Dietary consideration necessitates the use of simple, bland, non-irritating foods in small quantities at frequent intervals. In serious cases the hypodermoclysis and intravenous use of salt-and-sugar solutions may be required. Stomach washings often prove of great value

over a long period, and tonic treatment either by hypodermic injection or by mouth may be deemed advisable. General tonic treatment through massage or physiotherapy can aid considerably.

Pyloric Stenosis—Pyloric stenosis, as its name implies, means *narrowing of the stomach outlet*. This is due to many factors. It is not uncommon in infants and is regarded as congenital. The cause in these cases is assumed to be a nervous disturbance affecting the muscular structure of the pylorus (outlet) as a result of which *pylorospasm* occurs, with secondary hypertrophy (overgrowth) of the musculature. It is also probable that a similar manifestation occurs in adults; in this the pyloric musculature becomes spastic and eventually thickened, causing a narrowing of the outlet, with obstruction to the outflow of the stomach contents as the final result. A disturbance in the nervous control of the pylorus, either directly as an effect of disease in the nerves locally controlling this part of the stomach, or reflexly from other organs such as the gall bladder and appendix, may be the underlying cause. On the other hand, organic causes due to actual disease at the pylorus or in its immediate neighborhood can also produce a narrowing of the outlet of the stomach, causing hindrance to the elimination of stomach contents. Such organic causes are ulcer at the pylorus, adhesions around this area, duodenal ulcers, and growths in this neighborhood.

The symptoms will be characterized by many of the ordinary signs of indigestion, aggravated according to the degree of obstruction present. In organic obstruction the symptoms are likely to be worse, and considerable suffering is also experienced in the nervous or functional cases. Certain foods that are relatively indigestible, such as coarse vegetables, fresh fruits, and meats, will often lie in the stomach for many hours beyond the normal period and cause irritation to this organ. As a result of this irritation, the stomach enlarges because of an overgrowth of its musculature, and finally undergoes atony or stretching as the condition persists.

Painful symptoms may arise as the stomach violently tries to empty itself, especially if indigestible food has been eaten. This is not the case if simple, bland, more digestible food has been taken. Many persons will develop a tolerance for retaining food in the stomach for longer than normal periods, but occasionally vomiting does occur, with the ejection of exceedingly large amounts of food and secretions which had accumulated in the stomach over a period of hours or days. The vomiting usually occurs in those cases where the obstruction has become more pronounced and the stomach is unable to propel its

contents onward. Other general symptoms such as loss of weight, skin dryness, thirst, and weakness are not uncommon.

The abdominal examination may reveal that the abdominal wall is thin and that it usually bulges because of the filled and enlarged stomach underneath. Palpations with the hand and manipulation with the fingers often elicit splashing, gurgling noises due to the accumulated foods and secretions within the stomach. Upon closely inspecting the abdomen in long-standing cases, wavy movements (peristalsis) are occasionally noted.

In pyloric stenosis, the retention of food and stomach secretion will vary with the degree of obstruction present. When the obstruction is *benign* in nature, hydrochloric acid is usually found in the stomach contents. In *malignant* obstructions hydrochloric acid is frequently absent, but not necessarily so. Often fermentation occurs in the accumulated contents of the stomach, and in such instances an examination of this material may show the presence of yeast, bacteria, or sarcinae. When no hydrochloric acid is found in the contents, as is usual in cases of malignant obstruction, organic acids such as lactic acid and butyric acid are found instead. These substances are products of decomposition and emit a most disagreeable odor.

X-ray examination will greatly aid in the recognition of this condition and will enlighten the physician as to the progress of the disease. Mild cases may not show much change in the position, form, and size of the stomach, whereas in advanced cases definite variations will be evident. At times, when the stomach is dilated to a great degree, it may sink to a low level in the abdomen. The true character of the obstruction may also be ascertained by the X-ray studies.

The treatment of pyloric stenosis will depend upon the true nature of the condition. If the cause is ulcer, medical treatment including stomach lavage may be indicated. Simple, bland foods are best tolerated. When proper medical treatment fails, due to scar-tissue obstruction, surgery is usually indicated. In obstructions due to growths or adhesions, the elimination from the stomach is often so poor as to warrant surgical intervention.

Syphilis of the Stomach—An individual afflicted with syphilis does not necessarily exhibit a manifestation of this ailment in the stomach proper, but there are rare instances in which it does occur and the symptoms of indigestion may then be attributed to its effect upon the functions of the stomach. This disease is usually found in grown-ups of any age.

The symptoms often simulate those found in ulcer of the stomach,

and will depend in intensity upon the degree of involvement of the stomach wall by the syphilitic process. Pain, nausea, vomiting, belching, and bloating are common complaints. If the syphilitic lesion ulcerates, bleeding may occur, and if the ulcerative area is located at the outlet of the stomach it may eventuate in scar formation and give rise to obstruction at this point. Of course, other general evidences of this disease will ordinarily be found throughout the body. A Wassermann test of the blood is of importance and when positive may prove to be the clue to the existence of syphilis in the stomach proper.

When the disease involves the body of the stomach, the symptoms of stomach catarrh predominate, and the stomach secretion upon examination may reveal a diminution or entire absence of hydrochloric acid. When the lesion is deep and penetrating, it may involve the wall to such an extent as to create deformity in the X-ray shadow of the stomach. At times such X-ray deformities are mistakenly interpreted as cancer. When the lesion prominently involves the stomach outlet (pylorus), the X-ray film may reveal the stasis of barium beyond the normal period, showing food retention within the stomach beyond the six-hour limit.

The treatment of this condition requires, first of all, medical consideration directed toward the syphilis itself, such as the use of salvarsan, bismuth, or other medication by a competent physician, and such dietary and medical measures as seem indicated. Rest in bed is required at times to control hemorrhage, if this condition exists. If obstruction or unusual deformity of the stomach persists, following thorough medical therapy, surgery may be contemplated.

Cirrhosis of the Stomach—Cirrhosis of the stomach, also known as *linitis plastica*, is a rare condition which manifests itself in the form of a small, inelastic, thickened organ. The entire stomach wall is thickened, firm, and contracted, causing the stomach to be reduced in size, and the mucosa or lining is mammillated (pleated) in appearance. As a result of the thickening of the organ, the capacity of the stomach is reduced to a comparatively few ounces; this condition is often spoken of by physicians as a leather-bottle stomach.

The true underlying cause of the disease is not known, but opinions have been expressed which endeavor to associate the ailment with syphilis and malignancy. As in cirrhosis of the liver, so in this ailment, chronic alcoholism is presumed to play an important part.

The symptoms come on insidiously over a period of years and simulate those often seen in cancer of the stomach. The patients complain of poor appetite, pain in the pit of the stomach (epigastrium), nausea,

vomiting, and so on. At times bleeding occurs, manifesting itself in the vomitus or in the stool.

The abdomen, upon examination, may be tender and reveal a hard mass to the examining fingers of the physician. The general symptoms will include loss of weight, weakness, and emaciation, all the result of undernutrition.

The stomach contents will usually show a diminution or absence of hydrochloric acid, and the X-ray film will reveal a very small stomach, with a diminished barium content due to the reduced stomach capacity, and with a rapid emptying time due to the funnel effect produced upon the stomach pylorus (outlet), in consequence of which the barium material literally shoots through this part into the intestine. Today it is easy to discern the condition by direct observation through a gastroscope or through photographs made by the gastrophotor.

The treatment is more or less symptomatic. Improvement of the diet is accomplished by the prescription of more readily absorbable food and such other measures as contribute toward building up the patient. When medical measures are inadequate, an operation directed toward improving nutrition may be indicated.

Benign Tumors of the Stomach—Benign tumors of the stomach occur within different portions of the wall of the stomach and at various locations. Differing from cancer, they do not evidence signs of malignancy nor do they metastasize (spread) to neighboring glands or other organs. The true cause for their development is unknown, but it is believed that some of them result from congenital or developmental defects, indiscretions in diet, and alcoholism, or as a sequel to stomach catarrh and other constitutional processes. The growths may vary definitely in nature. Some of them are: mucous polypi (overgrowths and enlargements of the mucosa in tumor form), myomata (tumorlike enlargements of the muscle portion of the stomach wall), fibromata (tumorlike enlargements of the connective tissue structure), lipomata (tumorlike enlargements of fatty tissue), adenomata (tumorlike enlargements of glandular tissue), myxomata (tumorlike enlargements composed of mucoid tissue), and cysts (abnormal sacs containing fluid or semi-solid material).

The symptoms will depend upon the exact location, size, and character of the growth. When the growth is small and located in the wall of the mid-portion or body of the stomach, the symptoms are negligible. When the growth is large or involves a large portion of the stomach wall, the symptoms may be increased because of its

greater area of influence over the function of this organ. When the growth involves the wall at or near the stomach cardia (inlet) or pylorus (outlet), the symptoms will be definitely enhanced because of its obstructive effect on the phenomena connected with these openings. When the growth is exceedingly large and heavy, a sensation of weight may be felt in the epigastrium (pit of the stomach). A growth producing obstruction at the outlet of the stomach will cause a delay in stomach emptying, which again will result in a retention of large quantities of food beyond the normal period of time. Such symptoms of indigestion as belching, fullness, pain, and discomfort in the epigastrium may occur conjointly or separately. At times vomiting occurs, especially when there is hindrance to elimination from the stomach. Bleeding frequently occurs with such growths as polypi, or when any of the growths undergo ulceration.

A diagnosis of benign growth is often made when the X-ray photograph reveals evidence of a growth which, from the history, seems to be of long duration, and which does not show ravaging effects upon the general condition of the patient. Sometimes gastroscopy or gastrophotor studies may aid in making a proper diagnosis, but frequently the true nature of the growth is recognized only after an operation has been performed for its extirpation.

The treatment will depend upon the degree of complaint. In mild cases diet and medication will afford relief, but in severe cases which fail to respond to this means of treatment surgery is often necessary.

Cancer of the Stomach—This ailment is one of the most feared diseases and causes many people great concern through anticipation. Great numbers consult physicians for stomach symptoms which they imagine are due to cancer, and it is often difficult to eradicate this idea from their minds.

The disease itself usually occurs in individuals between the ages of forty and sixty, but may develop in younger or older persons. Its cause is at present unknown, and it is not believed to be hereditary despite the fact that instances of its regular occurrence in certain families have been noted. It may occur in individuals who have previously suffered from some form of indigestion, or in persons who have never experienced any previous stomach discomfort. It is impossible to say that irritation caused by improper foods or alcoholism has contributed to its production, although many authorities are inclined to think so because of the frequency with which cancer is found at the inlet or outlet of the stomach, where irritation or injury is most likely to occur.

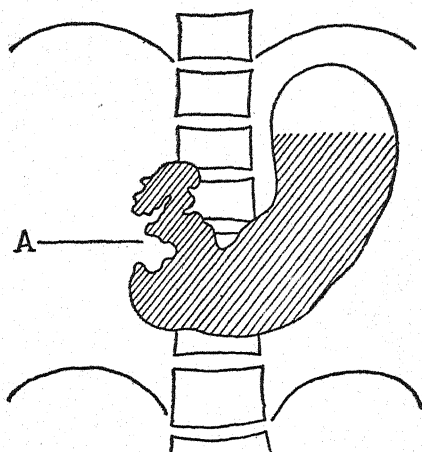
Cancer, as ordinarily referred to, is a tumor which originates in the *epithelial layers* or lining of the stomach, and extends either inward toward the interior surface or outward into the wall of the stomach. The growth may extend through the blood and lymph channels to other organs, either in the immediate neighborhood or to more distant regions. This process of extension of the disease is called metastasis. A rapidly developing growth may involve the liver, pancreas, omentum, mesentery, and peritoneum within a few weeks after inception of the process. The growth, the medical appellation of which is *carcinoma*, manifests itself in various forms: soft, semi-soft, and hard (in texture).

The symptoms of cancer of the stomach will vary in character and degree, depending upon the size, location, and degree of development of the growth. The symptoms are those of indigestion, including some or all of such complaints as loss of appetite, disturbed taste, bloating, belching, distress or pain in the epigastrium (pit of stomach), nausea, and vomiting. When the growth is located near the stomach cardia (inlet), disturbance in swallowing or hindrance to the entrance of food into this organ is encountered. When the growth is situated near or at the pylorus (outlet), vomiting may become a common daily symptom and the amount brought up will vary in accordance with the grade of obstruction that exists at this site. Some food may lie in the stomach for twenty-four hours or more. At times the growth undergoes ulceration and bleeding occurs, as a result of which the vomitus evidences blood, or the stomach test, when performed, will show the presence of blood in the stomach contents. When the blood lies in the stomach for a period of time, it is altered in appearance and looks like coffee grounds when vomited or extracted through the stomach tube.

In cancer the stomach contents do not necessarily evince a diminution or absence of hydrochloric acid, but in most instances this appears to be the case. The stomach ferments also are usually reduced in strength. When the growth is at the stomach outlet, food eaten many hours or days previously may be found, and in addition there is evidence of food fermentation, as indicated by the presence of yeast cells and Opler-Boas bacilli (organisms or germs presumed to be associated with lactic acid fermentation). Examination of the feces (excrement) may also show the presence of large quantities of food elements and blood.

An X-ray examination in this disease will usually present valuable demonstrable information. The growth may so encroach upon the

cavity of the stomach as to lessen its capacity and thus create defects in the filling of the stomach, as seen by use of the barium mixture. These characteristic signs are spoken of as filling defects. The defect will be seen at the point in the stomach corresponding to the growth area. Frequent locations are at the inner and outer curvatures of the stomach. When the growth is at or near the inlet or outlet, the



Excavated or eaten-out area A indicates a cancer of the pyloric antrum (lower pole of the stomach).

defects will be seen at these spots. When the growth is at the outlet only, the stomach may be enlarged or dilated to a great degree and the barium retained in its cavity for an extended period of time.

A physical examination of the abdomen will frequently reveal a hard mass to the investigating fingers of the examiner. The mass may be large or small and located either in the pit of the stomach (epigastrium) or to the right or left of this area. In advanced cases of the disease, the abdomen is usually quite thin, because of the loss of fat, and the general body will also evidence tissue loss.

The treatment of cancer of the stomach will depend upon the development to which the growth has already proceeded and upon the symptoms presented by the patient. If the disease can be diagnosed early, before metastasis (spreading) has taken place to any degree, early surgery involving complete and thorough removal of the growth is indicated. Occasionally pronounced improvement or complete cure

is attained by such an undertaking. In advanced cases, characterized particularly by obstruction at the stomach outlet, life may be prolonged through the medium of a new connection between the stomach and the small intestine, often referred to as a gastro-enterostomy, as a result of which nutrition is improved.

In addition, whether surgery is performed or not, the treatment will be symptomatic. Simple, easily digestible foods of high nutritive value should be given. Medicaments to stimulate the appetite, to reduce pain, to relieve indigestion, and to alleviate constipation or diarrhea are administered if necessary. Obviously the case should be attended by a physician.

Another type of malignant growth, which is as destructive to life as cancer but does not belong to the true cancer tissue group, is known as *sarcoma*. It is not an epithelial tumor but primarily a *connective tissue* growth. It is a rare condition and is believed to be due to a defect in tissue development. It may occur at any age, often in middle life. It manifests itself, as does true cancer, either in the wall of the stomach or on its inner surface. It occurs as small nodules or as a large mass, and is usually quite hard. It seldom involves the inlet or outlet of the stomach, as is frequently the case in true cancer. Bleeding from the growth is a common occurrence in sarcoma.

Tuberculosis of the Stomach—This is a rare disease in so far as its primary involvement of the stomach is concerned, but more frequently it occurs as a *secondary manifestation* in a person already suffering from tuberculosis of the lungs. It occurs during puberty or early adult life, and some authorities believe that it results from drinking the milk of infected cows.

The symptoms are those of indigestion and depend upon the location and degree of manifestation of the lesion in the stomach. At times the symptoms are mild and again they are severe, including one or more of such complaints as heartburn, belching, regurgitation, nausea, loss of appetite, and vomiting. When the lesion is located at the stomach outlet, obstruction to the outflow of food from the stomach may occur, and such symptoms of food retention as distress and vomiting will arise. When the diseased tissue undergoes ulceration, bleeding will occur and the vomitus or feces will, upon investigation, show the presence of blood. The stomach contents when examined may show a reduced acidity and a lowering in the ferment strength. The X-ray film will show signs of irritability in the stomach outline, and even defects when the involvement has attained depth. Often there is retention of the barium material beyond the six-hour

normal limit, due either to spasm or direct organic involvement of the pylorus (outlet).

Treatment should aim at improving the general health of the patient and at eliminating symptoms. Diet, sunshine, and general rest are indicated. Medication should be utilized to relieve pain or spasm and to improve the general body condition, as is the case in pulmonary tuberculosis. Occasionally mechanical measures such as stomach washing are required to bring relief, and when these efforts fail surgery may be resorted to for the purpose of eradicating the lesion entirely.

CHAPTER X

Diseases of the Intestines

Duodenal Ulcer—This ailment is often popularly called “stomach ulcer,” but in reality it is an ulcer of the duodenum (uppermost small intestine). It is the most common site of digestive ulceration, a fact elicited during the early part of the twentieth century.

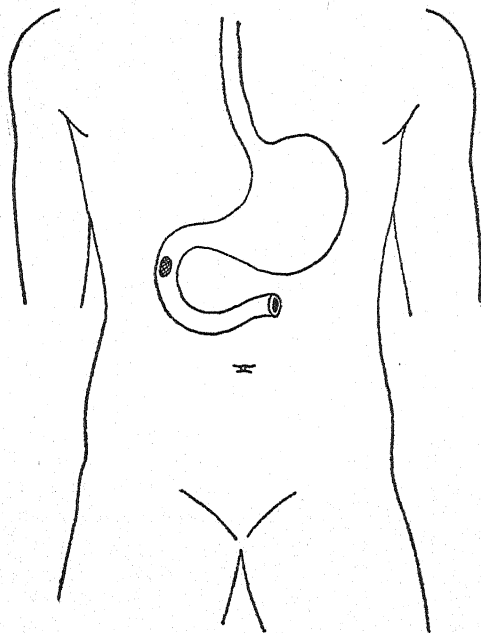
As in ulcer of the stomach, a definite cause is not ascribable but various opinions have been expressed. Nervous influences, emotional upsets, local anemia or lowered resistance in the lining tissue of the duodenum, embolism or clot within a small blood vessel in the wall of this organ, infection or local toxic influences, irritation caused by the stomach secretion or other near-by secretions, and some other irritative effects are believed to be factors in ulcer production.

It may occur in children and in adults of any age, but its most frequent manifestation is in young people and individuals in middle life. Patients complain of symptoms lasting for short or long periods of time. Some superficial ulcers heal quickly; others which are deep heal more slowly and are frequently accompanied by complications.

Ulcer of the duodenum will present various symptoms depending upon the nature of the lesion, its exact location, and attending complications. Some cases present no symptoms until sudden bleeding manifests itself, as a result of which the patient may become faint and shocked from the loss of blood, may vomit blood, or may present dark, tarry stools due to the presence of altered blood. In other instances the symptoms are those of mild indigestion; in many cases, however, they are severe and occur in periodic attacks as hunger pain or pain a number of hours after meals, accompanied by such other symptoms as heartburn, belching, nausea, and vomiting. The pain is usually in the pit of the stomach or just to the right. Patients who have had hemorrhage (bleeding) may give a history of fainting spells or sensations of faintness, vomiting of blood, or the presence of dark, tarry stools. Some individuals are free from symptoms for

months, only to have them recur at certain seasons of the year. This seasonal recurrence is a characteristic feature of duodenal ulcer. The general condition of most patients is good, but sometimes those who suffer considerable pain and eat poorly enter a deteriorated state of health and exhibit great loss of weight.

Ulcers that are deep and penetrate to the outer surface of the duodenum usually create peritoneal adhesions, which become attached



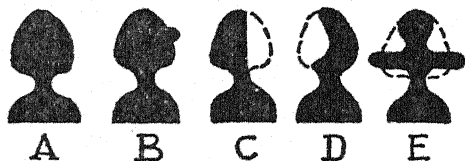
Dark spot shows the common location of ulcer in the duodenum.

to other adjoining organs and cause additional symptoms or, when they heal, produce deep scar-tissue contraction; this results in a narrowing of the duodenum and gives rise to obstructive symptoms. At times the ulcer penetrates the duodenal wall and forms a pocket extending beyond the alignment of the wall, causing symptoms due to food retained at that point.

An X-ray examination of this general area will usually furnish definite evidence of ulcer through the manifestation of signs of *irritability* in the duodenum in the early stages, and through the presence of *spastic deformity* or *penetration* (niche phenomenon or pocket

formation) of the duodenal wall in the advanced stages. Sometimes in well-developed duodenal ulcer the X-ray film will reveal *obstruction* to the elimination of food from the stomach because of a profound reflex spasm of the pylorus (stomach outlet) or because scar tissue had narrowed the caliber of the duodenum as the ulcer healed. The stomach in cases of duodenal ulcer will usually appear irritable; that is, it will show signs of *increased tone*, *increased activity* (hyperperistalsis), and *increased or rapid emptying* (hypermotility). The degree of stomach irritability will depend upon the nature of the lesion and its complications.

During fluoroscopy the examiner will usually elicit tenderness in the abdomen overlying the duodenum. The duodenum normally ap-



A portrays a normal duodenum (duodenal cap).

B portrays, on the duodenal inner border, a small pocket due to a penetrating ulcer.

C portrays a duodenal cap half-filled because of spasm or ulcer.

D portrays a duodenal cap incompletely filled because of spasm or ulcer.

E portrays a clover-leaf cap due to spasm or ulcer.

pears as a smooth-outlined, cone-shaped cap, but when it becomes diseased variations in its appearance are noted, depending upon the exact location of the lesion within the duodenum, its depth, its degree of healing, and its involvement of neighboring tissue structures.

Physical examination of the abdomen usually reveals, upon pressure by the examiner's hand, a definite *tenderness* in the right epigastrium (to the right of the stomach pit), and in advanced cases the patient may exhibit a strong protective *muscular reflex* in the muscles overlying this area. In rare cases, because of a low degree of sensitivity, the tenderness is absent or decidedly reduced.

A study of the stomach contents frequently evinces an increase in the amount of stomach *juice secreted* and in the degree of *acidity*. In the early stages of this disease the stomach empties itself quite rapidly, but in advanced cases *spasm* of the stomach outlet or *obstructive complications* may delay its evacuation.

The treatment is similar to that followed in gastric ulcer and in a

measure involves dietary limitation and discretion, alkali and antispasmodic medication. In cases of severe bleeding, the patient is forced to stay in bed until the hemorrhage is controlled. In intractable cases which do not respond to diet and mouth medication, intravenous or intramuscular injections are given. In fewer cases surgery is resorted to.

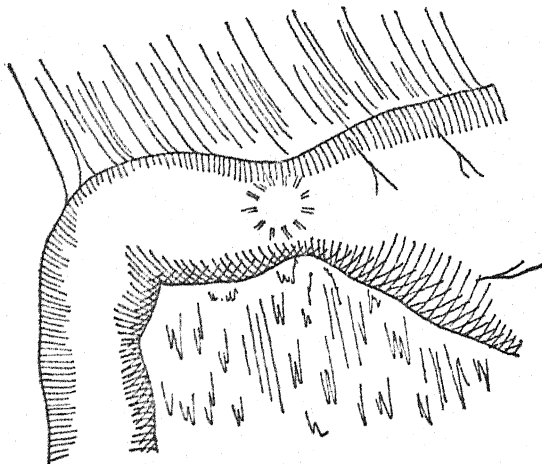
Duodenitis—Inflammation of the lining of the duodenum occurs occasionally, in either the *acute* or the *chronic* form. The *acute* form usually occurs in the course of, or as a sequel to, some other infection such as typhoid fever, pneumonia, influenza, and tonsillitis, or as an extension from a catarrh of the stomach. It is believed that eating improperly prepared or decomposed foods may invite its development. The *chronic* form of duodenitis results from one or more attacks of the acute condition.

The symptoms of *acute* duodenitis will depend upon the intensity of the inflammation present, and upon the extension of this process. It usually occurs as an indigestion attack—nausea, loss of appetite, fullness in the epigastrium, regurgitation, or vomiting—associated with headaches and constipation. At times some temperature rise is noted, with or without chills and sweating. Languidity and weakness are often experienced. Jaundice of a mild or pronounced degree may occur a few days after the onset, because of the spread of the catarrh or inflammation at the opening of the gall duct which controls the evacuation of bile into the duodenum. Interference with the proper emptying of the bile may lead to jaundice. Sometimes the inflammation spreads along the bile ducts into the liver and gall bladder. The jaundice varies in intensity and duration, and may last from days to weeks.

The symptoms of *chronic* duodenitis vary from that of a series of repeated so-called simple attacks of indigestion to a pronounced and protracted form of the disease. Poor appetite, belching, regurgitation, nausea, and vomiting may occur. The tongue is probably coated and the bowels are either loose or constipated. Occasionally, many hours after meals, pain of a hunger pain type may become prominent. Here also headaches, general languor, and nervousness predominate. If the process extends into the bile ducts, jaundice occurs and, when the liver, gall bladder, or pancreas become involved in the process, additional symptoms referable to these organs assert themselves. When the pancreas is involved, pronounced evidence of indigestion may be presented through the recognition of undigested food elements in the stool and also through the presence of sugar in the urine.

Examination of the stomach contents usually reveals such factors as lead to the development of duodenitis, and material obtained from the duodenum through a duodenal tube will exhibit increased amounts of *mucus* (slime), exfoliated *lining cells*, and *bacteria*. An X-ray study often will reveal a certain degree of duodenal irritability or irregularity in duodenal outline.

The treatment will depend upon the symptoms and the associated stomach findings. In the *acute* form, rest in bed for one or more



The deep and scarred appearance of the outside surface of the duodenum overlying an ulcer.

weeks is usually indicated. Simple foods such as milk either plain or digested, weak clear soups, and orange albumen at the start, to be followed by more solid, bland foods such as custard, cereals, toast, and junket as the condition improves, are advocated. Hot or cold applications to the abdomen may be advisable. Medication to improve the liver function and the bile flow, to correct constipation, and to relieve other untoward symptoms should be instituted.

The *chronic* form will also require encouragement of a proper bile flow through the administration of such drugs as favor this action. In addition, medication should be prescribed to stimulate bowel movement. Stomach tests may indicate the need of alkalies or acid medication. At times such ferment preparations as pepsin or diastase are given. Bland, non-irritating liquids or solid foods are usually advised.

Stomach lavages (washings) or duodenal drainages (by means of a small tube in the duodenum to drain off the duodenal contents and bile) are sometimes necessary.

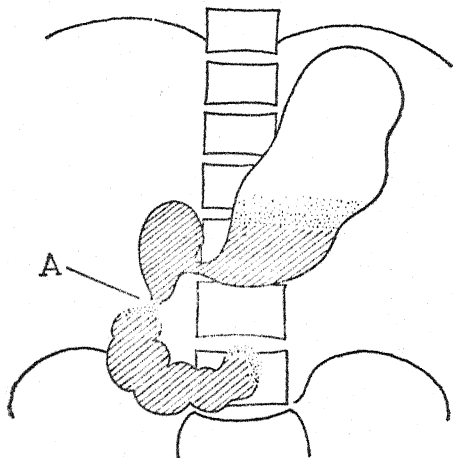
Duodenal Diverticulum—A *pocket* or *pouch* within the wall of the duodenum may occur because of a weakness in the wall due to a developmental defect; or it may follow as a complication of ulcer within the duodenum due to adhesions around this organ from without, which contract or pull upon the wall, or because of scars from within which contract deeply and through deformity create pockets.

The symptoms are either *mild* or *severe* and cause such manifestations as pain or distress in the epigastrium, nausea, belching, and vomiting. Often the symptoms are so insignificant as to be unrecognized until an X-ray observation suggests the existence of the condition. When the symptoms are very troublesome, however, a thorough investigation should be made to determine the nature of the diverticulum; if ulcer is the cause, medical treatment for this factor should be instituted. The characteristic X-ray finding in diverticulum is the presence of retained barium in the diverticulum or pocket for many hours or days.

The treatment will depend upon the severity of the complaint. Mild cases respond to a suitable bland diet and the avoidance of overeating. In more severe cases medication is employed to overcome irritability or spasm of the duodenum. When a diverticulum becomes inflamed, the condition is known as diverticulitis; this may require rest in bed for a week or longer and such medication as seems to be indicated. Occasionally stomach or duodenal washings help greatly, through the use of either a stomach or duodenal tube as seems warranted. In some cases which fail to respond to a thorough medical effort at cure, surgery is advised to remove the pocket entirely.

Duodenal Stasis—Duodenal stasis implies a *retention of the contents* within the lower portion of the duodenum far beyond the normal limits of time. This may be due to various causes such as impingement or pull upon the duodenum as occurs occasionally in so-called *dropped viscera* (visceroptosis), in adhesions about the duodenum resulting from previous inflammation of the organs in the immediate neighborhood or following surgery, and in organic ailments of either a benign or malignant nature involving the duodenum. When stasis occurs in the duodenum, it takes place above the point of constriction, the location of the diseased condition. This upper part of the duodenum becomes dilated, with the result that food and bile will usually flow back into the stomach in excess quantity.

The chief symptoms complained of by the patient are nausea, vomiting, and severe headaches of the migraine type. Occasionally pain of variable degree is experienced in the epigastrium, and in some cases the stricture effect becomes so pronounced as to produce signs of acute obstruction. When great loss of weight has occurred and



A indicates a stenosis (constriction or narrowing) of the lower duodenum near its junction with the jejunum. The dark shadows above the stenosis indicate the retention of barium in the upper duodenum and lower pole of the stomach many hours after it was ingested. The condition is referred to as duodenal stasis.

vomiting and constipation become prominent symptoms, malignancy of the duodenum should be suspected.

Various studies, including examination of the stomach contents, X-ray photography, and stool findings, will furnish corroborative evidence of the existence of stasis, or further enlighten the physician as to the true nature of the condition.

The treatment of the non-malignant condition may be of a medical nature, with prolonged rest and a diet of a simple, bland, yet nutritious character. If no favorable response is obtained, surgery should be resorted to. In the malignant ailment, surgery should be immediately advised for palliation or cure.

Ulcer of the Small Intestine—On rare occasions an ulcer may manifest itself at some spot in the small intestine other than the duodenum. The *jejunum* is a most likely location, and the *ileum* is not free from

such a possibility. In previous generations when typhoid fever was rampant this was a common occurrence, but now it is infrequent.

When an ulcer occurs in the small intestine it will manifest itself through signs of *irritability*. When it is superficial, this irritability will evoke *hypermotility* (rapid emptying) and *hyperperistalsis* (increased muscular contraction) of the small bowel. In some instances *spasm* of the intestine occurs, as a result of which the patient will complain of pain in varying degree. When the ulcer is deep and involves the bowel wall to a considerable extent, the symptoms of *obstruction* may appear. In such cases the symptoms will depend upon the degree of the obstruction, and food will be retained above the site of constriction in variable quantity. Pain will vary from a dull to an acute, colicky type. Ulcer of the jejunum is a not infrequent occurrence in patients who have previously had a gastro-enterostomy (an operation by which the stomach is connected with the jejunum).

As a result of the rapid emptying of the small intestine, the stool upon examination will show undigested food elements or blood. X-ray films will usually evidence spasm or deformity at or near the ulcer level in the small intestine.

The treatment is virtually identical with that prescribed for duodenal ulcer. Rest in bed is as a rule very important, in conjunction with a proper restricted diet. The degree of ulcer depth or intestinal involvement will in a measure control the treatment. In intractable cases surgical excision of the ulcer area may be indicated.

Gastrogenous Diarrhea—Diarrhea that can primarily be traced to a stomach origin is not uncommon. In such cases the stomach elaborates a *poor* or *defective secretion*, incapable of properly digesting the various foods which enter this organ. Because of the poor quality and the limited quantity or absence of the hydrochloric acid or the ferments usually found in the stomach, the foods are poorly digested. Especially does this apply to meat foods. The connective tissue which holds the muscle fibers of the meat product together is not dissolved by the stomach ferments and acids; consequently this food enters the small intestine improperly prepared for further digestion by the intestinal secretions, thus causing *irritation* in the small bowel. When irritation takes place in the bowel, manifestations of *hyperperistalsis* and *hypermotility* occur and the food is rushed through the small intestine in undigested and loose form.

The symptoms usually occur gradually over a period of months or years. At first the complaints are of an occasional mild indigestion and diarrhea, which gradually eventuate in more frequent attacks and

more pronounced form. When the condition becomes sufficiently aggravated, the victim may have colicky pains and lose considerable weight and strength because of poor absorption of food. The irritation of the bowel may become pronounced at times; evidence of this is seen in the presence in the stool of large amounts of mucus, blood, and pus. In addition the patient often complains of intestinal colic in varying degree.

An X-ray examination will ordinarily show a rapid emptying of the stomach and small intestine, and the stomach test will reveal either a pronounced diminution or the complete absence of hydrochloric acid and ferments in the gastric secretion.

The treatment should involve the use of substitutive medication to replace what is lacking, as hydrochloric acid and ferments. Of course additional treatment may be required at the beginning to control a violent form of diarrhea and to overcome colic if it exists. Other supportive treatment is usually needed to improve the general health, and bland, non-irritating foods, puréed when necessary, should be employed.

Intestinal Dyspepsia—This appellation covers many conditions which manifest themselves somewhat similarly. In some instances it is regarded as a *starch indigestion*; in others it is believed to be an *albuminous indigestion*. All in all, it is thought that intestinal discomfort usually occurs in persons who have previously experienced stomach disturbances. Occasionally, when the condition is characterized chiefly by colicky or tearing types of pain, it is spoken of as *enterospasm*, whereas in those cases where excessive distention of the lower abdomen occurs it is referred to as *flatulence*.

To make a definite statement as to the cause is impossible, since every case is different in the degree of manifestation and in character. It is believed, however, that in most cases the chief cause is a *too rapid emptying* of the stomach or small intestine, or of both these organs, in consequence of which the food has undergone incomplete digestion before it reaches the large intestine. The primary trouble is often after thorough study found to reside in either the stomach or the small intestine, or in both.

When the stool examination reveals a light, foamy, bulky, sour-smelling excrement, acid in reaction, with evidence under the microscope of undigested starch cells, the condition is spoken of as a starch indigestion. On the other hand, when the stool reveals a darker than usual color, a not too bulky mass, but a foul-smelling, putrefactive excrement, usually neutral or alkaline in reaction, the condition is

referred to as a putrefactive intestinal indigestion. There are times, however, when a combination of both forms of indigestion, called the saccharo-butyric type, may exist, but this is not common.

Some authorities feel that these disturbances depend upon a reduction in or lack of *intestinal ferments* which ordinarily act upon either the carbohydrate or the albuminous food elements. When digestion is incomplete, the familiar symptoms result.

The symptoms usually come on insidiously in persons who previously were well, or will manifest themselves from the start in aggravated attacks following indiscretions in the diet. The sufferers of *starch dyspepsia* complain of greater abdominal distention and diarrhea, as well as of gurgling sensations or other noises throughout the abdomen. In addition, when the abdominal manifestations are pronounced, they do not feel well generally. The *putrefactive dyspepsias* may have a less pronounced distention, but the diarrhea is prominent at times, and when the condition is fully developed the patients feel ill because of the accompanying auto-intoxication. Under such circumstances the victim may be sallow, slightly yellowish in appearance, and generally irritable, with additional symptoms of indigestion or with loss of appetite, thirst, and coated tongue. Headaches, nausea, vomiting, and salivation may also ensue in addition to signs of general depression, anemia, and nervousness.

Microscopic examination of the stool will reveal in both conditions evidence of undigested food elements corresponding to the nature of the condition prevailing. In starch dyspepsias undigested starch cells will predominate, whereas in the putrefactive dyspepsias undigested connective tissue and muscle fiber cells will be prominent. In addition, some fat cells and vegetable fibers may also be seen.

The treatment naturally will depend upon the character of the existing dyspepsia. It is essential, as far as possible, to find the true nature of the underlying causes of the condition and of any possible complications. The treatment is directed in great measure toward correcting or alleviating the symptoms and controlling the diet. The *carbohydrate dyspeptics* are at first restricted to a non-carbohydrate dietary regime, with only protein and fat foods included. Later, after decided improvement over a period of time, a predigested form of carbohydrate may be allowed. Medication, including ferments directed toward the digestion of carbohydrates, is also prescribed. For patients with *putrefactive dyspepsia*, where albuminous decomposition is the chief manifestation, the treatment will be directed toward reducing that process. Medication to diminish or destroy the bacterial decom-

position is indicated. Foodstuffs which counteract putrefaction are given; these include carbohydrates and foods containing minimal amounts of protein such as milk or vegetables. In addition, intestinal irrigations or duodenal lavages are occasionally administered. Such antiseptic medication as seems indicated should be employed. Surgery is rarely advised in these conditions.

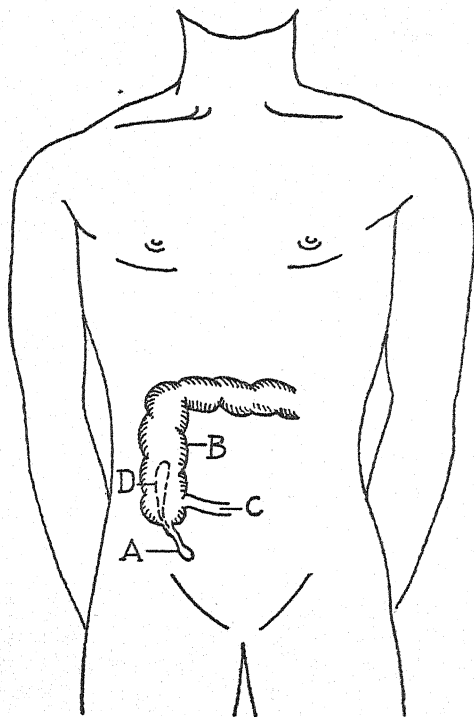
Intestinal Stasis—Intestinal stasis implies a condition characterized by an *accumulation of contents* within portions of the intestinal tract because of the retardation of its onward movement, as a result of which toxic material is absorbed into the circulation. This interference with the onward movement of the bowel contents may be due to many causes: so-called adhesion bands about certain portions of the bowel, or kinking of the bowel at various locations owing to tense points of ligament fixation; disturbances in the nerve supply of the intestine at certain sites, as a result of which the musculature of the bowel loses its power of propulsion; and retardation of muscular bowel activity due to tone loss, often accompanying the condition known as prolapse of the bowel or ptosis (dropping) of the intestines, usually the result of prolonged constipation.

When the contents are retained within the bowel for a considerable length of time, the condition spoken of as *intestinal toxemia* often arises. In addition to a lack of proper bowel emptying, the symptoms frequently are headache, drowsiness, mental ineptitude, insomnia, fatigue, loss of appetite, and dizziness. They are believed to be due to the absorption of toxic material created within the intestinal contents by the process of bacterial decomposition. Some authorities feel that the symptoms are not purely toxic in origin, but rather the result of irritative influences produced by the accumulated fecal matter, a milder process.

The treatment will depend upon the cause of the stasis, which should be corrected as effectively as possible. X-ray films may aid greatly in determining and relieving the cause. Various other studies of the stomach contents, the stool, the blood, and the urine will also serve a useful purpose. Proper diet, medication which seems to be indicated, and intestinal irrigations, and any other measures that tend to stimulate bowel movements are all warranted procedures.

Appendicitis—Appendicitis, as is well known, is one of the most common ailments with which man is afflicted. It occurs as an *acute*, *sub-acute*, or *chronic* process and involves the *appendix*, which is usually located in the right lower quadrant of the abdomen. At times the inflammation involves not the appendix but lymphoid tissue

within the *ileum* (lowermost small intestine) or *cecum* (beginning of the large intestine), and then the condition is referred to as *perityphlitis*. This general section of the bowel is often spoken of as the



A—the appendix when it leads downward, as is usual.

B—the ascending colon.

C—the lowermost small intestine.

D—the appendix when it is directed upward, as occurs occasionally.

“tonsil of the intestine,” because of the frequency with which inflammation occurs in this area and because the lymphoid tissue here closely simulates the tissue of the tonsil.

Opinions as to the causes of appendicitis are many. Some believe it is due to the peculiar position of the appendix close to the small and large bowel, its narrow calibration which invites blockade of its secretion and contents, its tendency to kink, and its blood supply which,

though adequate normally, when once disturbed has a poor chance of ready recovery. The immediate inciting factor in the production of inflammation of this organ is presumed to be an invasion of the lining of the appendix or near-by tissues by disease-producing organisms or germs, such as the colon bacillus, staphylococcus, or streptococcus. Some authorities believe that the disease is secondary to infection in other neighboring tissues or such general infections as influenza and tonsillitis, or the result of direct irritation of the appendiceal wall by parasites or foreign bodies.

The *sub-acute* inflammation is believed to be confined to the mucosa or lining only, and is regarded as a simple catarrhal process which frequently responds to the "ice bag" treatment. The *acute* process is a deeper infection invading the lining and its underlying layer (sub-mucosa). Acute conditions which have temporarily healed occasionally eventuate in the formation of adhesions or appendiceal kinking, thus giving rise to chronic symptoms, with considerable discomfort in the right lower quadrant of the abdomen, the result of poor drainage from the appendix lumen. The *chronic* inflammation is a low-grade infection, of long duration, which usually follows previous acute attacks. When the lumen of the appendix drains well, these chronic cases respond favorably to medical treatment, but such treatment must be carefully watched over by a physician lest dangerous complications develop. When drainage is poor, gangrene or perforation of the appendix with complicating peritonitis may occur. Similarly, inflammation which progresses may become purulent, and may also cause peritonitis by extension or perforation.

The *acute* case usually develops suddenly in a person previously well, and the chief symptom is pain either in the epigastrium (pit of stomach) or in the right lower quadrant, or it may occur in both areas simultaneously. Sometimes nausea or vomiting accompanies the condition. The temperature varies from a low to a fairly high degree, and the patient will usually feel tired and languid. The bowels, before an attack, are frequently constipated. After a short period of hours or days the pain may be localized in the right lower quadrant of the abdomen, near a spot known as McBurney's point. In rare instances the localization of the pain is elsewhere, as in the right upper abdomen or in the right lower back, either because the appendix is located in these areas or because of a reflex nerve effect.

Examination of the abdomen will usually elicit definite *irritability* of the tissues over the right lower quadrant, in the form of increased tenderness, increased muscle tension, or a defensive muscle reaction.

In advanced inflammation, a pronounced *muscular rigidity* will be found over this site, and occasionally a definite tender mass may be felt.

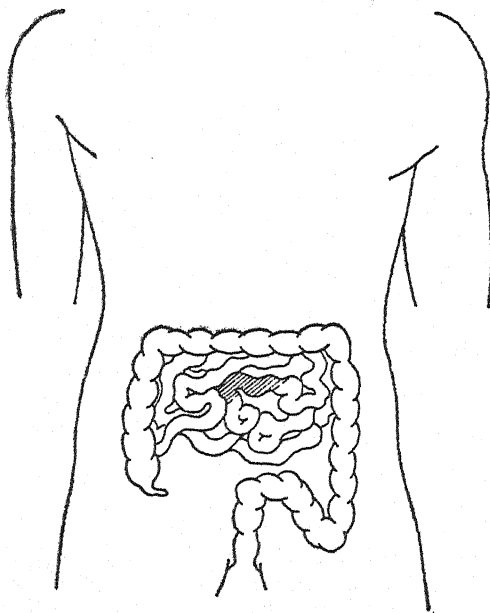
The general condition will vary depending upon the severity of the inflammation. At times the course of the disturbance is mild, whereas on other occasions it is very stormy, giving rise to grave anxiety. In the former a favorable response is noted after the third or fourth day; in the latter an unfavorable impression gains ground at this time, usually the result of complications. The *pulse rate* and *fever* are two important indices to follow. In questionable cases, where doubt prevails as to the existence of an appendicitis or perityphlitis, a *leucocyte count* (the number of white blood cells in the circulation) may prove of value in settling the diagnosis. Such complications as abscess formation, gangrene, and peritonitis will prolong the illness and make the course of the disease more grave. Great care must be taken to avoid general peritonitis.

So-called *chronic appendicitis* is not even believed to exist by some authorities. They regard this chronic complaint as due to a *perityphlitis* or an involvement of the lymphoid tissue in either the ileum or cecum. Others in great number, however, feel that a chronic appendicitis exists, especially in persons who previously have suffered an acute attack. The common symptoms are pain or soreness in the right lower quadrant of the abdomen, with little or no temperature. Walking, exercise, or undue movements may aggravate the condition. These patients in addition often have indigestion, in the form of poor appetite, bloating, belching, nausea, coated tongue, and constipation. The symptoms vary in intensity and occur either in attacks, with intervals of freedom for days, or as constant daily expressions. Tenderness over the appendix area is elicited after careful examination by the physician. In some cases a reflex irritation of the stomach is the chief indication of trouble, with few if any references to the appendix region. After the removal of the appendix, in these cases, the stomach indigestion often clears up entirely.

In chronic appendicitis, X-ray examination may serve to establish the diagnosis—through the elicitation of tenderness directly over this organ during fluoroscopy; through the inability of a tender appendix to fill with barium, thus indicating closure of its lumen; through the retention of barium in the appendix for many days, once it has been filled; and through evidence of a consistently displaced appendix in abnormal areas, or a kinking of this organ. Occasionally the X-ray film discloses the presence of accumulated hard excrement or a so-

called *fecalith* within the appendix lumen; this should be viewed with suspicion.

The treatment of appendicitis in any form is essentially surgical, if dangerous complications are to be avoided and life safeguarded. When the condition is correctly diagnosed, surgery is usually indi-



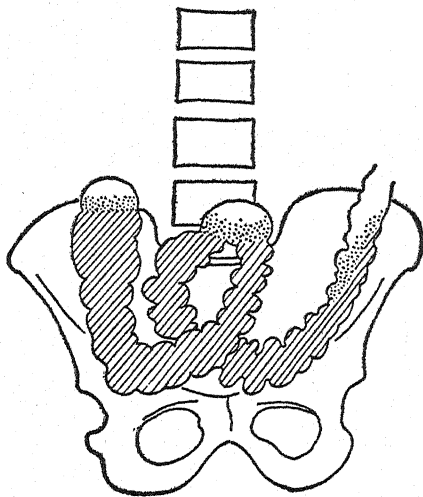
The large intestine, surrounding the coils of small intestine, is shown from its beginning to its end in the rectum.

cated; when mistakenly diagnosed cases are operated on, the results are often unsatisfactory. The nature of the operation will be influenced by the judgment of the surgeon, and such measures as drainage after surgery will also depend upon whether the complications were of such a character as to warrant their use. The sulfa drugs are now being employed with great success in these complications of appendicitis.

Mild, simple, catarrhal cases may be treated medically if closely watched, but complications should be looked for and guarded against. If the progress is not sufficiently satisfactory, surgery should be resorted to before complications have developed to such a degree as

to endanger the patient. Medical treatment usually consists of ice-bag applications over the appendix area, to allay inflammation, and such other symptomatic measures as seem to be indicated. Limitation of the diet over a certain period of time is desirable.

Enteroptosis—This condition implies a state in which the intestines are situated at a lower level in the abdomen than is normally the case.



Showing the large intestine, ascending and transverse portions, ptosed or "dropped." These parts are ordinarily at a higher level in the abdomen.

The condition is referred to as coloptosis.

It is usually associated with the condition known as *visceroptosis*, in which most of the visceral organs assume a low position in the body. The ptosis or "dropping" of the intestines is usually congenital in origin, but may possibly be acquired during life as the result of a serious fall or following pregnancy in women.

Often there are no definite symptoms, but in extreme forms of the disease, because of a drag or pull upon the ligaments and other tissues to which the organs are attached, symptoms of pain, tenderness, and nervous reactions may ensue. The pain may be reflected in the chest and abdomen, and such symptoms as belching, bloating, and constipation are not uncommon. Because of the nervous effects of this condition and the introspective mental state often induced, many of its victims become hypochondriacs.

Treatment is usually symptomatic. Bland, non-irritating food is advised. A proper abdominal support should be fitted, to aid in relieving abdominal tension. Constipation, if aggravated, should be relieved. At times irrigation and abdominal exercises are valuable to pursue. Surgery is seldom advised.

Cholera Nostras—This is an *acute catarrh* of the stomach and bowels which simulates Asiatic cholera and is frequently spoken of as *summer complaint*. It affects both children and adults, occurring usually during the summer. It is believed to be due to an infection of the intestinal tract caused by germs which ordinarily reside in this region, such as the paratyphosus bacillus or the streptococcus.

The symptoms as a rule appear suddenly as an acute stomach and bowel upset associated with vomiting and diarrhea. The stool usually becomes watery and colorless, and simulates the rice-water stool seen in true cholera; but a thorough examination will not reveal the comma bacillus, the infective germ found in the stool in the latter condition. The patients usually complain of slight abdominal pains or none, but may refer to a sensation of weakness in the pit of the stomach. Ordinarily they feel generally weak and thirsty, because of the loss of considerable fluid through the bowels. In severe cases symptoms of collapse arise. Fever of variable degree may occur, because of the catarrhal process involving the small and large intestines. Most patients make an excellent recovery.

The treatment requires a strict adherence to a diet consisting of broths and cereal soups from the start, with other liquids such as milk, meat soups, Postum, and tea to be added gradually. In addition, it may be necessary to give astringent preparations such as chalk or bismuth to control the diarrhea, or other medication to reduce gas formation. The general condition of the patient requires such supportive treatment as seems to be indicated, and where great loss of fluid has occurred the need of administering physiological salt solution into the tissues by injection may become imperative. Upon improvement, toast, stale bread, and cereals are added to the diet for a period of time, with the further addition of other foods later on. Fruits, vegetables, and other irritative foods are avoided for a long time.

Acute and Chronic Dysentery—Dysentery is regarded as an infectious disease characterized by inflammation and ulceration of the *ileum* (lower part of small intestine) and the *colon* (large intestine). The *epidemic* form of dysentery is caused by Shiga's bacillus; the *endemic* form is usually produced by the parasite known as Entameba

histolytica. The endemic form is common in tropical countries, whereas the epidemic form has frequently occurred in Europe and Asia. Occasionally an endemic form of dysentery may result from irritation produced by such intestinal parasites as *Balantidium coli*, *Schistosoma japonicum*, and *Lamblia intestinalis*, which will be referred to in a later chapter. The true nature of the form of dysentery encountered will be recognized through the organism found upon examination of the stool.

The disease is characterized by *inflammation of the lining* of the intestines, and varies from a congestion or catarrh to a severe inflammation usually complicated by the formation of irregularly shaped small and large *ulcers*. At times the ulcers become confluent and destroy large portions of the intestinal lining, or abscesses develop which may perforate either into the lumen of the bowel, or through the intestinal wall into the abdominal cavity, causing peritonitis.

The *acute* form of dysentery usually occurs as a mild *diarrhea* which gradually gets worse. The number of bowel movements may increase to fifteen or more movements a day, and the stool will contain not only fecal matter but large amounts of mucus, blood, and pus. The victim often complains of abdominal cramps and tenesmus (pain in the rectum). Such general symptoms as fever and loss of weight and strength are common, as are loss of appetite, thirst, nausea, and vomiting. The acute form will last two or three weeks, ending in recovery or death.

The *chronic* form of dysentery may simulate the acute variety, but it runs a much longer course, many weeks or months. In the chronic form, *constipation* may alternate with diarrhea. The stool usually reveals large quantities of mucus, with occasional evidences of blood. Some acute forms clear up considerably, but are followed by the symptoms characterizing a mild chronic form. In other forms the patients continue to suffer for years and finally recover or gradually deteriorate to end in death.

Since this disease, either *acute* or *chronic*, is of an infectious nature, it should be impressed upon every person who comes in contact with it that great precaution should be exercised in preventing its spread.

The treatment will depend upon the underlying cause, although certain general principles are followed in all forms of dysentery. Rest in bed, temporary abstinence from certain foods, adherence to liquid mucilaginous drinks, and applications of heat to the abdomen are common observances. Cereal broths and other astringent drinks are given to reduce the number of bowel movements, and only after the

stools begin to approach normalcy in appearance and number are more solid and nutritious foods given. Irritating foods, however, should be avoided for months.

When the dysentery is due to an *amoebic infection*, such drugs as emetin and ipecac are often employed; when it is the result of infection with Shiga's bacillus, an anti-dysenteric serum is given. Other medicines in the form of bismuth or kaolin are given to check diarrhea, and many other preparations presumed to have a specific effect upon the organisms producing the infection may be tried.

In some cases, in which intestinal pain and tenesmus (pressure pain in the rectum) predominate, it may be necessary to attempt to relieve these symptoms through irrigation of the lower bowel with some medicated solution or weak salt solution. Occasionally opiates or other similar acting drugs are utilized to reduce pain.

In chronic dysentery, irrigations of the bowel with an iodoform emulsion or other similar preparations may be used, and such general supportive measures as will tend to improve the patients' welfare may be employed.

Catarrh of the Intestines—This condition manifests itself in either an *acute* or a *chronic* form and may have a number of causes underlying its production. Although the manifestations and symptoms vary somewhat depending upon the true cause, the general picture is about the same.

A condition referred to as *enteritis* or *enterocolitis* will often arise following a stomach upset. This is not uncommon where tainted or decomposed foods have been eaten. In other instances the intestinal catarrh follows from the constant use of coarse, irritating foods or of cathartics. At times intestinal catarrh may follow exposure to dampness or cold, or result from drinking too much cold or iced fluids. Bowel catarrh is also believed likely to occur as a *secondary manifestation* in individuals who suffer from circulatory congestion of the blood vessels in the bowel wall. This is a not infrequent occurrence in persons afflicted with diseases of the heart, lungs, kidneys, or liver.

Other forms of bowel catarrh also occur as a purely *nervous disturbance*, and some follow as a *complication* or secondary manifestation in diseases of the stomach, liver, gall tract, or pancreas. The symptoms are very much the same. A true diagnosis is established by detailed studies involving the medical history, the stool findings, a rectal examination, and X-ray observations.

In the *acute* forms of the disease, the mucosa or lining of the bowel is swollen and congested, and the surface is usually covered with

mucus (slimy material) or purulent matter (pus). Sometimes the lining will erode or ulcerate and give rise to bleeding.

In the *chronic* form of the disease, the lining of the bowel at the involved areas becomes thickened, because of the chronic inflammation that exists and because of an overproduction or overgrowth of connective tissue (tissue which holds the various layers of the bowel wall together). After the process has continued for a long period of time, this chronic inflammation gradually changes the lining of the diseased bowel from a thickened to a thinned texture (atrophy). As a result the surface of the bowel lining usually is decidedly thinned, and many of the secreting glands are reduced in size or entirely obliterated. The connective tissue throughout the disease area is increased in amount as well as contracted. This last characteristic reduces the size of the bowel lumen considerably, at times to the point of constriction.

The symptoms of intestinal catarrh are very much the same irrespective of the cause, but the intensity of the complaints will correspond to the degree of the inflammation and will differ according to whether it is acute or chronic. *Diarrhea* or looseness of the stool and frequency of bowel movements are outstanding symptoms. The bowel contents may move through the intestines much faster than normal because of the increased activity of the bowel musculature. The increase in the amount of bowel fluid is due to the rapid propulsion of the material through the intestines before absorption has taken place, and also to the increased flow of intestinal secretion because of irritative effects upon the glands within the bowel wall. The number of stools passed in twenty-four hours may vary from two to as high as fifteen or more. The consistency will vary from fluid to semi-solid material. The color will vary from a light yellow to green or black, depending upon its constituent make-up. The odor may be either mild or offensive. The stool examination usually reveals the presence of various forms of undigested food, considerable mucus, and blood or pus.

Some patients will complain of abdominal pain, either mild or severe, frequent bowel movements, and rectal tenesmus. The fever is mild or high, depending upon the degree of infection and intestinal damage. The general condition may be good or bad. As a rule the patients feel weak and languid. They complain of poor appetite, nausea, and vomiting for a time, but these symptoms gradually disappear with improvement. Other complications may at times occur, such as jaundice because of gall-tract involvement, and urinary disturbances

because of kidney irritation. The abdomen, upon examination, is flat or distended, depending upon the amount of gas present, and noises may be heard throughout the bowels (borborygmus) because of increased intestinal peristalsis (muscle contractions). The abdomen may or may not be tender, and the loops of intestine can be felt by the examiner's fingers as rope-like or sausage masses.

The symptoms, as stated above, simulate one another in various types of intestinal disturbance, but when the condition is limited to definite portions of the intestine there may result certain slight modifications or variations in the symptoms, the X-ray findings, or other studies which are made.

When the disease is confined to the jejunum it is spoken of as a *jejunitis*. When the ileum alone is involved it is referred to as *ileitis*. Examination of the stool and X-ray observations will usually aid greatly in determining the diagnosis. The presence of undigested food elements may suggest small intestine involvement, although the stomach, liver, and pancreas must not be overlooked as possibly affected. Large quantities of mucus usually indicate that the bowel wall is affected. The presence of bile-stained food elements in the stool may indicate catarrh of the small intestine, owing to the fact that the food material was rushed through the bowel without sufficient time for the bile to undergo alteration in the small intestine. Various chemical studies upon the stool will further enlighten the physician in this direction.

An inflammation confined to the lower ileum, for which no specific cause has thus far been ascertained, is known as *regional* or *terminal ileitis*. In this condition the inflammatory process is confluent or skips certain healthy areas. It may involve only the ileum, or in addition the neighboring cecum. It is usually a chronic, slowly developing ailment characterized mainly by diarrhea and an ache or pain in the right lower quadrant of the abdomen. As the disease progresses, the passage of material through the affected bowel is retarded almost to the point of obstruction. X-ray studies usually reveal the disease through a characteristic narrowing of the caliber of the ileum as indicated by streaks of barium at the diseased site. Continuous or alternating attacks of diarrhea are the symptom; this usually fails to respond to treatment by medical measures, and surgery must finally be resorted to.

At times the catarrhal inflammation involves only the large intestine; it is then spoken of as *acute* or *chronic colitis*, depending upon whether the condition is acute, of short duration, or chronic, of longer duration. When the process is confined to the sigmoid portion of the colon it is

referred to as *sigmoiditis*. When the lesion is localized in the rectum, the condition is known as *proctitis*.

The chief symptoms characterizing inflammation of the large intestine or colon are pain in the abdomen, either mild or colicky in type, and also a sensation of tenesmus (distress in lowermost part of the rectum near the anus). Bowel movements vary from a few to many. The quantity is either scant or profuse. The odor may or may not be offensive. Mucus may be seen in the stool in fairly large amounts, often as large casts corresponding to the size of the intestinal lumen. Fever will vary from a low to a comparatively high degree. A stool examination may reveal the presence of blood and pus. When the disease is in the lowermost part of the colon the stool is apt to have more form. An abdominal examination may elicit pain or tenderness throughout, or confined to definite areas. Sometimes hard, sausage-like masses of bowel, which are either tender or painful, are felt by the examining hand. The abdomen is sometimes distended. A prominent complaint in involvement of the sigmoid is obstinate constipation.

The treatment of *acute* intestinal catarrh usually involves either abstinence from food for the first twenty-four to forty-eight hours, or limitation of the diet to liquid foods, such as cereal broths and weak tea, avoidance of all irritating foods, and rest in bed for days or weeks, depending upon the intensity of symptoms. Keeping the body and abdomen warm and avoiding exposure to inclement weather is a good rule to follow. Such medical measures as seem advisable to relieve pain, diarrhea, or constipation should be respected.

The *chronic* forms of the disease require dietary regulation and the avoidance of such foods as seem to disagree with the patient. To relieve diarrhea, such astringent medication as appears indicated should be given, and, to overcome constipation, mineral oil or similar preparations may be advisable. Irrigations with physiological salt solutions or other types of solutions will at times prove beneficial. Short-wave therapy to the abdomen or rectum is also a valuable form of treatment.

Mucous Colitis—Mucous colitis is a condition with which the general public seems to be fairly well acquainted, judging from the author's experience. It is characterized by the passage of large quantities of slime (mucus) from the large bowel. This is due to a catarrh or mild inflammation of either a small or extensive portion of the colon. Many authorities believe that it is primarily of *nervous* origin, but others feel that it is a mild inflammation only. Many individuals who have this disease are of a nervous type or undergo considerable

nervous strain. It is possible that certain kinds of food or various climates or localities may be responsible for its production. In some instances there may be a familial factor in its development, probably because of some nervous or glandular cause which had been transmitted at birth.

The outstanding symptom is the passage of large amounts of *mucus*, which may be eliminated in large, lengthy casts or in smaller broken casts or stringy strands. The slime or mucus may be passed alone or in conjunction with fecal matter. Before the bowels move, the victim usually experiences severe colicky pains, but this may vary in severity in different cases. The stool when passed may be narrow, ribbonlike, or pencil-shaped. In the mild forms of the ailment, the patient may not be aware of the existence of the condition until his physician has examined the stool and found the large quantities of mucus. Occasionally the condition clears up readily and completely, but more often it recurs over a period of years after intervals of freedom from symptoms.

The treatment will depend upon the severity of the complaint as well as upon the nervous condition of the patient. Treatment directed toward the improvement of the mental and nervous state of the individual is most important. Moderate exercise and short-wave therapy, in conjunction with mental diversion, may greatly benefit the victim. A proper, non-irritating, nutritious diet is always indicated. Some authorities stress the need for adherence to a milk and vegetable diet, but the majority do not hold this view. In some cases irrigations with various medicated solutions will prove beneficial. Other medications, including vaccines, are employed to control the various symptoms.

Ulcerative Colitis—This condition is characterized by the development of small *isolated ulcers* or by a process of *extensive ulceration* in the colon. These small individual ulcers sometimes coalesce and form larger areas of ulceration. It is believed that *bacterial infection* is concerned with the production of these ulcers within the colon; the source of the infection may come from such organs as the tonsils, sinuses, and gall bladder, or from the wall of the intestine itself.

The ailment usually begins as an *acute* manifestation, with such symptoms as diarrhea, loss of appetite, and abdominal pain and tenderness, with or without fever. An acute attack may run from a few days to a few weeks. Occasionally the condition clears up, but often the acute symptoms only subside, to be followed by a gradual development of the *chronic* form of the disease. Frequently patients

in such chronic cases feel fairly well over a period of years, only to complain, during times of acute exacerbation, of such symptoms as are described above. The stool usually contains undigested foods, mucus, blood, and sometimes pus. Upon examination the abdomen is usually tender, and often the bowels are felt as stiff, sausage-like masses.

When the acute phase of the disease subsides, as it does in many instances, the condition gradually improves and assumes a chronic nature. The fever disappears, the bowel movements become much less frequent, the stool more solidified, and the general state of the patient distinctly improved. However, from time to time, following dietary indiscretion, exposure to inclement weather, or some form of mental irritation, recurrences of acute symptoms of variable degree occur. By avoiding such invitations to trouble, individuals may go on living comfortably for many years.

In other cases which persist and cause considerable distress, complications such as intestinal perforation may at times develop, with local or general *peritonitis* as a consequence. Adhesions occasionally arise, causing partial or complete bowel *obstruction*. Infection of the ulcers rarely results in local *abscesses* of the intestinal wall or in a general systemic infection.

The treatment of the acute symptoms requires rest in bed for a period long enough to control the condition and bring about improvement of a general character. This may vary from weeks to months. At times even in a chronic case a patient may require a number of weeks of rest in bed. In acute cases, liquid or semi-solid foods of a non-irritating nature are given first; as improvement is noted, more solid foods are added. The diet should have ample nutritional and caloric value.

The medical treatment should be directed toward the alleviation of troublesome symptoms such as diarrhea, pain, or spastic constipation. Some authorities advocate the use of medicine to stimulate healing of the ulcer areas, others suggest the use of vaccines of various types. In some instances, where the ulceration is in the rectum, local direct treatment of the diseased areas may alone be sufficient to produce healing. In other cases irrigations of the colon with medicated solutions prove of value. In those cases which utterly fail to respond to medical measures, surgery may be resorted to in a final attempt to stimulate healing of the ulcerative areas.

Diverticulitis of the Colon—Diverticulitis of the colon is a not uncommon condition. It implies an inflammation of small, hernia-like

protrusions of the bowel wall known as diverticula. These diverticula extend over various parts of the large intestine, particularly the lower half, and usually contain fecal matter. Sometimes hardened fecal matter becomes lodged in one of these protrusions or *pouches* and causes irritation. In this way inflammation may assert itself and result in the creation of diverticulitis. The diverticula are either *congenital* in origin or *acquired*, probably through constipation.

The diverticula may exist for years without causing symptoms, but when inflammation occurs symptoms come on suddenly in the form of pain, nausea, vomiting, and fever, very much like those encountered in appendicitis, except that the tenderness and pain is usually confined to the left side of the abdomen. The patient may previously have complained of pronounced *constipation*, with or without alternating diarrhea. The stool often reveals blood, mucus or pus. The X-ray film usually evidences the presence of these pouches or diverticula which project beyond the normal outline of the intestinal wall.

The treatment is directed toward preventing the accumulation of fecal material in the diverticula. This is accomplished by reducing constipation and softening the stool. In acute inflammations, rest in bed is warranted, and, as in appendicitis, ice bags to allay inflammation. After the acute symptoms have subsided, irrigations may prove beneficial, and medication directed toward healing the inflamed pouches is often given. In some cases surgery is required to drain an abscess or to remove an obstinately inflamed pouch which fails to respond to medical care.

Intestinal Tuberculosis—This ailment may affect any portion of the small or large intestine but is most frequently found in the *cecum* (beginning of the large intestine). The tubercular process occurs as a *hyperplasia* (overgrowth of tissue) or as an *ulceration*. It is due to infection by the *tubercle bacillus*, of either the human or the bovine type, the latter acquired from the animal either through the drinking of milk or through the eating of diseased meat. Infection of the bowel wall by the human type of bacillus is presumed to arise in most cases from the lungs, primarily the seat of the disease. It is possible, however, that the disease will in rare instances manifest itself primarily within the bowel wall; it is then believed to be the result of a bovine infection. At times the condition will manifest itself throughout the bowel in a large number of small *tubercles* (tiny elevations of tubercular tissue); this is spoken of as *miliary tuberculosis*. When the disease spreads to the peritoneum covering the intestines it is referred to as a *tubercular peritonitis*.

The symptoms will vary with the type of tubercular manifestation. Pain is a common complaint and will vary in intensity and constancy. Fever occurs in mild or pronounced degree in accordance with the type of disease presentation. Diarrhea is a common symptom and varies in degree. The stool may contain, in addition to undigested food elements, considerable mucus, blood, and pus. Where blood is lost in considerable quantity, a secondary anemia occurs and the patient presents a very pale appearance. In the *ulcerative* form of the disease the patient loses ground rapidly, whereas in the *hyperplastic* form the decline is slower and the symptoms not so distressing, manifesting themselves chiefly as an abdominal distention, mild colic, and alternating constipation and diarrhea. In some instances reflex disturbances cause symptoms of stomach indigestion, such as nausea, heartburn, bloating, and belching.

An X-ray study often aids in the recognition of complications. The abdominal examination may elicit enlarged lymph glands or sausage-like masses of large intestine. When the tuberculous process is in the sigmoid flexure or the rectum, an examination through the sigmoidoscope or proctoscope will usually reveal the lesion. If the stool examination should evidence the presence of tubercle bacilli, this may substantiate the diagnosis.

Treatment primarily involves prophylactic care, as in pulmonary tuberculosis, so as to curtail the spreading of the disease. Patients who have pulmonary tuberculosis should also be warned against swallowing their sputum, to prevent the possibility of reinfection through the digestive tract. The diet should be nutritious, to provide enough sustenance, and at the same time non-irritating.

Distressing symptoms should be controlled by proper medication such as sedatives, anti-spasmodics, and astringents. Measures to improve digestion and the general health, such as sunlight, natural or artificial, and tonics, are valuable adjuncts. Often diversion in the open country or mountains proves beneficial. In some cases surgery is advisable and curative in its effects if the ailment is not recognized too late, for by removing an entire tuberculous segment of bowel the disease may be completely eradicated.

Intestinal Syphilis—This is a rare condition and may be either congenital or acquired. In certain instances the disease primarily affects the *rectum*, because of the proximity of this organ to the genital tract. More often the condition is a part of a general syphilitic process, and manifests itself in the lower *ileum* and *large intestine* as secondary or tertiary manifestations of the disease. These tertiary lesions frequently

develop into ulcerations, which bleed and upon healing may form contraction scars, with a narrowing of the intestinal lumen.

The symptoms will depend upon the degree of intestinal involvement and the nature of the disturbance. They will vary and may include abdominal pain, distention, diarrhea or constipation, tenesmus, and the elimination of mucus, blood, or pus in the stool. When the lumen of the bowel has been narrowed by contracting tissue, symptoms indicating partial or more pronounced obstruction will occur. In such cases the stool may appear narrow and pencil- or ribbon-shaped.

An X-ray study will often aid in providing information to establish the diagnosis. So also will such blood examinations as the Wassermann and Kahn tests and spinal fluid studies in this direction. Examination of the sigmoid flexure or the rectum may reveal direct evidence of the syphilitic process in the form of extensive superficial ulcers. Scrapings from these ulcers occasionally reveal the germ or spirochete.

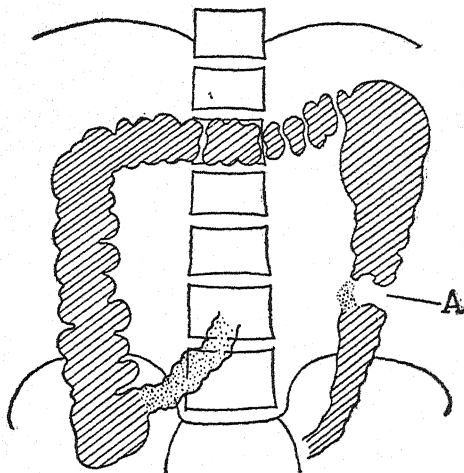
Treatment, once the diagnosis is clearly established, should be directed against the underlying infection, syphilis. This, of course, is accomplished through the use of the various anti-syphilitic drugs, such as salvarsan or its derivatives, bismuth, iodides, and so on. More recently the new drug penicillin has been suggested as a cure for this disease. Such other measures as are indicated to control the various symptoms of intestinal disturbance should be employed.

Intestinal Cancer—This is a very frequent occurrence in the large intestine, but quite rare in the small bowel. The most common location is in the *rectum*; the disease is found less frequently in other parts of the colon. There are two chief types of growth: *medullary cancer*, which is a soft, large, extensive growth that invades the bowel wall in cauliflower fashion; and *scirrhous cancer*, which is usually a small, hard growth that tends to undergo contraction and is less extensive than the medullary form. The disease may *metastasize*, or spread to other organs—more immediately to the lymph glands, peritoneum, and liver. The growths can cause obstruction of varying degree within the bowel, depending upon their size or the degree of tissue contraction, and they may ulcerate and bleed or become inflamed, thus creating complications.

The symptoms will depend upon the location of the growth and upon the complications associated with it. In those rare instances where the growth involves the *small intestine*, such symptoms as result from disturbances in this area will arise. These are nausea, loss of appetite, pain in the upper or mid-abdomen, belching, vomiting,

and even jaundice when the growth encroaches upon the opening of the common bile duct.

When the cancer involves the *colon*, symptoms referable to disturbances within the colon will arise, and these will vary in accordance with the exact site of the disease and its complications. Such symptoms are mild or severe abdominal pain, constipation of a gradually



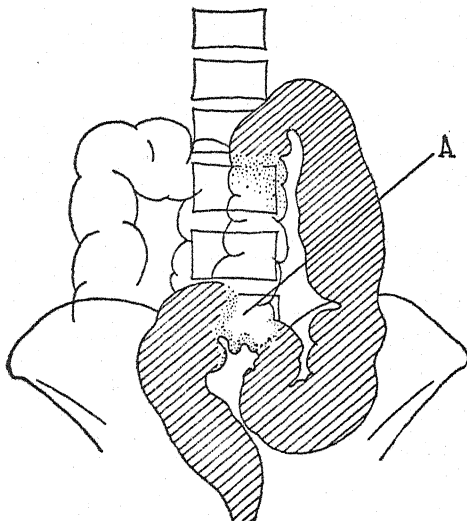
A indicates an excavated or eaten-out defect created by a cancer affecting the descending colon.

increasing variety with or without distention, weakness, anemia, and slow loss of weight. When obstruction of the bowel occurs, signs of auto-intoxication develop, with the oncoming of nausea and vomiting. The stool may evidence mucus, blood, and pus.

When the cancer affects the *rectum*, the symptoms prominently manifest themselves as pain in the lower back or tenesmus in the rectum, especially following bowel movement. At times the pain radiates to the genital organs and thighs. Often the primary complaint is a mild constipation, which gradually becomes aggravated. Later on diarrhea often alternates with the constipation. In advanced cases the growth can impede the elimination of fecal matter from the rectum, and distention with colicky pain may become prominent above the site of the growth.

Manual examination of the abdomen in cases of tumors involving the small intestine or colon often reveals enlargements or masses

which may or may not be tender upon manipulation. An inspection of the rectum through a rectoscope will reveal any existing growth in the rectum. Insertion of the finger into the rectum will often indicate the presence of a growth, and in women vaginal examination also will aid in the establishment of the diagnosis and the recognition of metas-



A—an excavation or defect in the sigmoid portion of the colon, the result of cancer.

tasis or spreading to adjoining lymph glands. An X-ray study will aid greatly in the recognition of a slowly advancing colon growth and give information as to the location, size, and obstructive characteristics of the cancer.

The proper treatment at present is surgical, and the earlier the diagnosis is established the better the prognosis. Complete removal of the growth by excision has often produced cures, especially in cases detected early. In advanced cases only palliation is attained, through entero-anastomosis (new connection between intestinal segments side-tracking the growth) or through a colostomy (establishment of an opening leading from the colon to the abdominal surface) to effect bowel-content elimination. In far advanced cases, where surgery is not warranted, only such medical or dietary measures are advocated as will relieve suffering. In some rectal cancer cases radium application is often tried, with varying results.

Other Intestinal Tumors—Sarcoma and lymphosarcoma are growths which rarely occur in the intestine and, unless recognized early, pursue a ravaging course like that of cancer. They arise from the intestinal lining or lymphatic portions of the bowel wall. An early diagnosis followed by thorough surgical extirpation may eventuate in definite improvement or cure. Unfortunately early recognition is not easy, and like cancer the disease progresses toward a fatal outcome.

Other growths not malignant in character may also develop within the bowel wall. The symptoms will depend upon the size and location of the growth. The tumors, depending upon their structural make-up, are referred to as *adenomata*, *myomata*, *fibromata*, *lipomata*, and *polypi*. Large or deep-seated tumors may create mechanical disturbances of considerable consequence.

At times polypi, when extensive in development or when extremely enlarged, cause obstructive symptoms. The condition known as *polyposis* of the intestine implies an extensive involvement of certain portions of the bowel wall, particularly the colon. This is often recognized, upon X-ray examination, through a mottled appearance of the barium shadow within the colon, created by these numerous polypi which extend into the intestinal lumen. Some authorities believe these growths invite cancer development, but others question this opinion. Occasionally polypi bleed considerably. When the process involves the rectum, an examination by means of the proctoscope will reveal its presence.

The treatment of these conditions will depend upon how seriously they affect the individual. Sometimes dietary and medical procedures will suffice to correct the symptoms, but when these measures fail surgery may be warranted. In instances of isolated polypi in the rectum, fulguration with the electric needle will destroy the growths.

Idiopathic Dilatation of the Colon—This condition, also known as Hirschsprung's disease, implies a dilatation or stretching of the colon. It is believed to be congenital in origin and the usual part of the colon affected is the *sigmoid flexure* or the entire *descending colon*. Occasionally the whole colon is involved. It is often seen in children, but rarely in adults.

The symptoms are chiefly constipation and inadequate emptying of the bowel. The affected part of bowel is usually filled with fecal and gaseous accumulations because of its inability to force these contents out. When the condition becomes progressively worse, stool may accumulate in the dilated part of the bowel for days or weeks and give rise to auto-intoxication, or the stool will become so hard through

dehydration or drying as to cause obstruction to a certain extent. Violent colic occurs occasionally when the bowel has not been emptied for a long period. The stool, when passed, is extremely offensive in odor because of putrefaction.

The abdomen in cases of this kind may disclose great distention of the involved portion of the bowel, often clearly outlined to the examiner. X-ray studies, through barium by the mouth or by enema, usually portray shadows of the bowel which definitely indicate the existence of this condition. The stool, upon examination, may reveal blood and pus, probably the result of intestinal wall irritation.

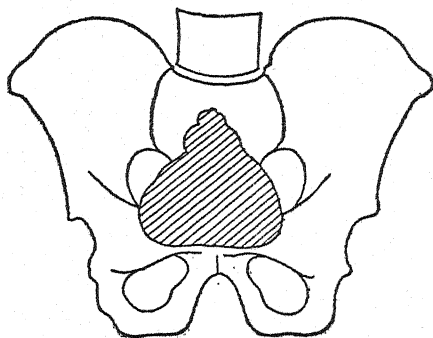
The treatment is primarily directed toward emptying the bowel of its contents and attempting to activate the dilated and diseased segment. Mineral oils should be given internally to lubricate the bowel and to soften the stool. At times mild cathartics such as milk of magnesia will facilitate movement. The diet should be bland and non-irritating. Enemas are employed to a great extent, and vegetable oils are frequently administered by this means to soften the stool and stimulate evacuation. Excellent results have recently been obtained in a twelve-year-old boy by the employment of gymnastic irrigations; the treatment has reactivated a tardy inactive bowel and thwarted a tendency toward stool accumulation and consequent auto-intoxication. After eight months of treatment, this boy has shown remarkable improvement in general health and a definite increase in weight.

Constipation—One of the most common complaints with which humanity is afflicted is constipation. Faulty modes of living which interfere with the natural call to defecation (bowel movement), insufficient exercise, eating insufficient food of the variety which stimulates bowel activity, and, on the other hand, temporary overstimulation of bowel activity by purgatives and cathartics may invite constipation.

This chronic ailment manifests itself in various forms, the chief of which are *spastic* and *atonic* constipation. Other forms result from congestion of the blood vessels of the bowels as a result of heart, lung, liver, and kidney diseases. Some forms follow as a result of the loss of body fluids, as in fevers, diabetes, and glandular disturbances. Still other forms result from disorders of the nervous system and brain, or occur in the wake of a general debilitating affection. Those digestive ailments in which constipation is often a symptom have been mentioned throughout this volume in their proper place.

Spastic constipation affects any part of the colon, but usually involves the *descending colon* and *sigmoid flexure*. In this condition the nerves controlling muscle tone and contraction are believed to be unduly

stimulated because of increased sensitiveness. This may be a purely nervous disorder or one associated with nutritional, glandular, or blood disturbances. In some cases the constipation is confined chiefly to the



Shows an accumulation of barium in the rectum three or more days after its ingestion. This form of constipation is referred to as dyschezia.

rectum, because of a spastic influence exercised over the muscles of the anus (outlet).

Atonic constipation is believed to result from a *loss of muscle tone* in the portion of the bowel affected. Because of this tone loss, the propulsive power of the bowel wall is reduced and constipation results. Common sites of this type of constipation are the *cecum* and *sigmoid flexure*.

Another form, probably more frequent in its occurrence than is realized, is that resulting from a loss of response to stimulation of the defecation centers (located in both the brain and the spinal cord). The rectal lining (mucosa) in such cases has probably lost its sensitiveness, or the centers, either in the spinal cord or brain, do not respond in a normal manner.

Constipation, except for the delay in bowel emptying, usually produces no other symptoms of importance. In many instances, however, after a prolonged period of time such symptoms as distention, borborygmus (noises in bowel), and mild pressure or sensitiveness within the abdomen may occur. In severe forms of constipation, pain or colic due to a lack of evacuation may occur, and occasionally other complaints such as loss of appetite, coated tongue, disturbed taste, nausea, fullness, headache, dizziness, sleeplessness, and despondency can arise. Some of these symptoms are due to reflex nerve involvement

or to auto-intoxication. At times the stool becomes dry and hard and may produce signs of obstruction.

Occasionally the constipation produces *intestinal catarrh*, and such symptoms as characterize this condition arise. Pressure and irritation of the bowel wall by hardened accumulated feces can result in ulcer formation and, more rarely still, perforation of the ulcer into the abdomen. *Hemorrhoids* will often result from pressure in the rectum during constipation. The bowel movements will vary in size and shape from goat-dung and pencil stools to large round masses of feces. In many instances the stool is coated with thin or thick layers of mucus (slime). X-ray studies will often reveal delays in bowel emptying for periods of days or weeks.

The treatment will depend upon the nature of the constipation, upon the intensity of manifestation, and upon complications. Often a proper diet made up of sufficient quantities of vegetables and fruits will correct or improve constipation. Occasionally improvement in the mode of living, sufficient rest, regulation of the habit of moving the bowels, the drinking of sufficient water, avoidance of the use of foods and liquids which tend to constipate, and indulgence in moderate exercises will tend toward overcoming constipation.

In severe forms of constipation, abdominal massage or some forms of electrotherapy which aim at stimulating the bowels may prove beneficial. At times sitz baths, hot or cold, are employed, or enemas consisting of salt solution or other medicated preparations. Physicians during the past few years have been successful in improving many cases of constipation through so-called gymnastic irrigation treatment.

Various drugs are given by way of the mouth to correct this condition. They include anti-spasmodic medications, such as atropine and belladonna for spastic constipation, and cascara, rhubarb, magnesia, and licorice powder, in conjunction with agar or psyllium seed products, for atonic constipation. Mineral oil and bile salt preparations frequently prove meritorious.

The cure of constipation is likely to be effected if a properly qualified physician, well trained in the care of such cases, makes a thorough study of the cause of the condition and institutes the indicated measures for its correction.

Enterospasm—This spasm may involve any portion of either the small or large intestine, though usually confined to a large or small section. It may be a purely *nervous* or *functional* disturbance, or it may be the *result of disease* elsewhere, as in disorders of the brain or spinal cord. At times it is a *reflex expression* from such ailments as

affect the gall bladder, appendix, kidneys, urinary bladder, genital organs, and rectum.

The simple, functional type of enterospasm frequently occurs in individuals of a nervous type who have probably eaten too much food or who have bolted their food. In some of these cases the stomach will empty too rapidly, before the food has been properly digested there, and as a consequence the intestinal tract is irritated and spastic manifestations result.

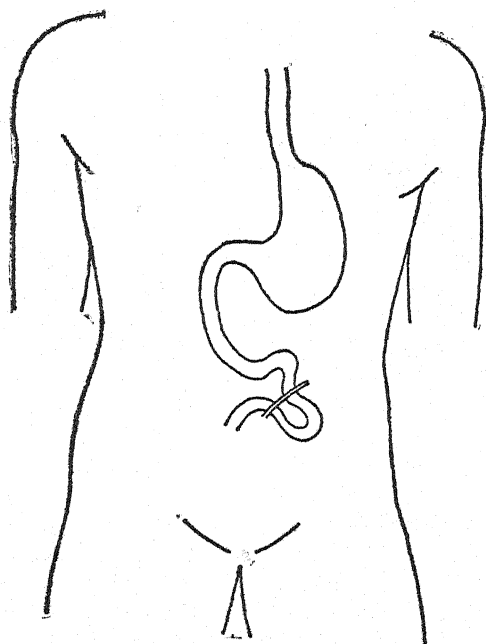
The victims complain of violent pain of a colicky or tearing type, depending upon the degree of spasm. The intestine above the point of contraction is distended. After the cessation of the spasm, the bowels relax and expulsion of gas and loose stool frequently take place. Examination of the abdomen will usually elicit tenderness and the intestines may be felt as hard, stiffened masses. The X-ray film in these cases will usually portray spastic contraction or increased intestinal tone involving certain portions of the bowel.

Treatment depends for success upon a recognition of the true underlying cause. In the simple functional cases, anti-spasmodic and sedative medication, along with regulation of the diet and the mode of living, may suffice. The avoidance of cold drinks and exposure to cold is also to be observed. In complicated cases, medical or surgical attention to disturbances in other organs may be necessary.

Intestinal Obstruction—This condition implies a blockade within some portion of the bowel, as a result of which elimination of the contents is retarded. It is often referred to as *intestinal ileus* and may be slow or sudden in its onset. The causes are many and varied. They consist of adhesions about the intestine, angulation or kinks of the bowel, twisting of the intestine, pressure of other organs or tumors upon the bowel, a paralysis of certain segments of the intestinal canal referred to as paralytic ileus, diseases such as tuberculosis, syphilis, or cancer which involve certain portions of the intestine and result in the production of a blockade, and the presence of large foreign bodies or large, hardened masses of feces in the bowel lumen.

The symptoms will vary with the degree of obstruction and its location. The toxic effects are usually more pronounced in an obstruction higher up, as in the small intestine, than in one lower down, as in the colon. The symptoms come on either slowly or suddenly, depending upon the slow or sudden development of the obstruction. Pain may be severe, colicky, or mild in nature, and will be confined to the upper or lower abdomen depending upon the segment of intestine affected. After obstruction has become almost complete, vomiting occurs and

the material ejected may have a fecal odor. When this stage is reached, the bowels usually have not moved for days and the abdomen may be distended considerably. Because of the toxemia which develops in these cases, the patients usually become very ill and if the condition is not quickly relieved collapse and death may follow. In cases which develop



Showing how adhesions may sometimes become joined to the intestine and pinch off a loop of bowel, thus causing obstruction.

slowly, an X-ray examination will aid greatly in diagnosis. In those which develop suddenly, the history and symptoms will usually be of sufficient clarity to suggest the diagnosis.

The treatment, as a rule, is surgical. Medical treatment in the form of stomach washings or medication directed toward relieving spasm may be tried, but too much delay in this direction often removes the opportunity for cure which early surgery affords. Other medical measures to improve the general condition of the patient should, of course, be resorted to, but surgery to relieve the obstruction is usually necessary irrespective of the nature of the blockading lesion.

Embolism and Thrombosis—This condition occasionally affects the *mesenteric vessels* which carry blood to the intestinal tract. An *embolus* (plug of tissue) or *thrombus* (clot of blood) within the branches of mesenteric vessels may, depending upon the size of the branch involved, create mild or severe symptoms. When a very small branch is affected a small intestinal ulcer may ensue, but when a larger vessel is involved an entire segment of bowel can become gangrenous.

The disease usually occurs in people over fifty years of age who have heart or liver disease, and in many who have arteriosclerosis (hardening of the arteries). At times it follows in the wake of infections involving the appendix, intestines, and pelvic organs.

The symptoms may arise *suddenly* or *gradually*. In cases which arise *suddenly*, severe abdominal pain, nausea, distention, constipation or diarrhea with the passage of blood, tenderness in the abdomen, and general weakness are frequently prominent manifestations. As the condition becomes worse, inability to empty the bowels and symptoms suggesting intestinal obstruction arise. The diagnosis is not readily made, and if surgery is delayed coma and death may occur. In cases which come on *gradually*, a history of such digestive disturbances as nausea, heartburn, bloating, vomiting, and constipation or diarrhea with mild or moderate abdominal pains are revealed to have existed for months or years, probably the result of congestion of the digestive organs. In mild cases a small ulcer often develops in the stomach or bowel, but in the more severe cases the blood supply may become reduced to such a degree as to invite gangrene of the bowel, an extremely grave complication.

The treatment will vary to a certain extent with the intensity of the disturbance. In mild cases medical consideration alone may suffice, but in severe cases which point to the probable development of a gangrene of the bowel, with or without obstruction, surgery if performed early enough is likely to bring about a good result.

CHAPTER XI

Diseases of the Rectum and Anus

Hemorrhoids or Piles—This very common condition implies the existence of *varicose veins* in the *lower rectum*. The veins are dilated and distended with blood, as are the varicose veins so often seen in the lower limbs. The dilation of the veins varies in degree, and the condition is often referred to accordingly as first-, second-, or third-stage hemorrhoids. These usually are swellings of veins which reside in the lower or deeper layers of the lining wall of the rectum and force their way into the mucosa (upper surface layer of the rectum). They vary from a rather small enlargement of the vein to a swelling the size of a grape or walnut; when they are viewed directly, the color is usually blue or deep red.

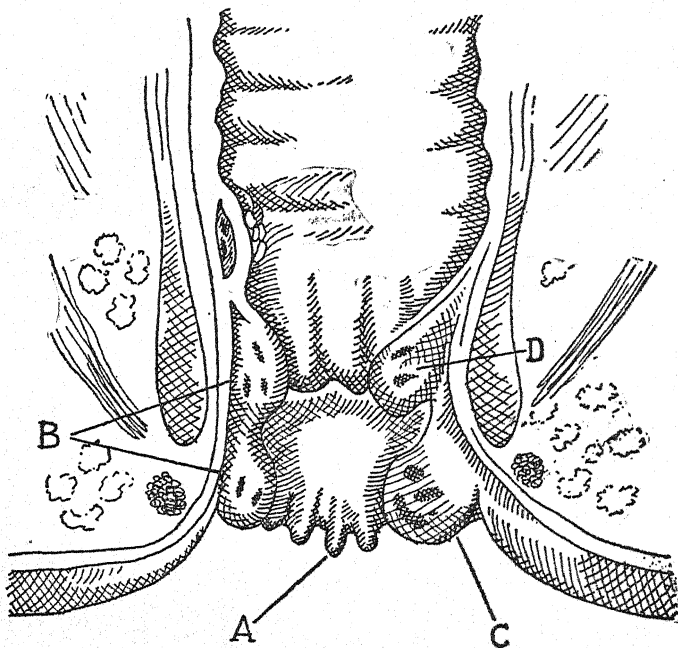
Hemorrhoids which protrude or burrow out beyond the anus (rectal opening) are referred to as *external piles*. An *internal pile*, however, may temporarily come down and protrude from the anus; this type of hemorrhoid is frequently referred to as external, but usually it may be pushed back into the rectum by the physician.

External hemorrhoids consist of different varieties: first, those which are *varicose* or *congested* veins; second, those which are *thrombotic* (blood clot or hemorrhage just beneath the skin or mucosa of the lowermost part of the rectum or of the anus); third, so-called *skin tags* which are projections or overgrowths of skin about the anus. *Internal* hemorrhoids are *dilated* veins, usually distended with blood.

Hemorrhoids are regarded as due to strain or pressure upon the rectal area because of protracted constipation, because of sedentary occupation, and following pregnancy or catarrhal conditions of the rectum. It is also a common complication in people who suffer from heart and circulatory diseases or lung, liver, or abdominal disturbances.

The symptoms will vary from slight to severe in degree. At times the condition exists for years without its presence becoming known.

Sensations varying from mild to pronounced *pressure* or *pain* in the anus are experienced. An external hemorrhoid of thrombotic character is usually painful. Irritation about the anus and itching may also be prominent symptoms. In many instances bleeding is the outstand-



Longitudinal section of the rectum showing:

- A—skin tabs or remains of old external hemorrhoids.
- B—hemorrhoid, part of which is external and part internal.
- C—external hemorrhoid.
- D—internal hemorrhoid.

ing complaint, and when this continues for a time anemia may set in to a pronounced degree. Often individuals bleed from other causes, and it is imperative therefore that a proper examination be made through a proctoscope or sigmoidoscope to rule out such conditions as polyps, ulcerations, or growths. At times, because of irritability about the anus, constipation becomes quite pronounced and reflex pains may develop in the lower spine, over the bladder region, or in the thighs. Occasionally emptying of the bladder is reflexly impeded.

The treatment of hemorrhoids varies at the hands of different authorities. Correction of constipation and a proper dietary regime will often benefit many mild cases. Simple healing ointments and suppositories often prove of value. The avoidance of sedentary habits also aids in rectifying constipation, with its associated congestions of the rectum. Mild cathartics, moderate exercises, mineral oil, and such other local measures as enemas and irrigations often relieve constipation and accumulations of fecal matter within the rectum, thus indirectly clearing up early hemorrhoids.

External, thrombotic hemorrhoids may be treated by hot or cold applications or by the local application of witch hazel. In rare instances the pile is incised and the clot expressed. *Internal* hemorrhoids, when fairly well advanced, are treated by injections directly into the hemorrhoid or into the tissue underneath it. This is probably the best form of treatment for the condition, and excellent results have been obtained with this method. When recurrences take place in cases that have apparently been cured for years, re-injections are made on and off as required. The material often used for injection is phenol dissolved in a vegetable oil, but other solutions are sometimes employed.

Some authorities rely on surgical extirpation of hemorrhoids and do not resort to medical or injection measures. Unfortunately surgery is occasionally followed by poor results such as narrowing of the rectum, interference with the proper functioning of the sphincter muscles (shutter) of the anus, and recurrences of the hemorrhoids.

Fissure—Fissure in the anus is a common condition which simulates a small crack or tear in appearance. It is probably produced by the passage of hard fecal matter or foreign bodies through the anus; these tear the tissues as they emerge. The tear is seen at the junction of the skin and mucosa of the *rectum*, and is usually found at either the rear or front aspect of the anal circumference.

The symptoms usually are pain or burning in the region of the anus following or during bowel movement. In rare cases the pain is excruciating, especially in severe constipation. Upon examination through the rectoscope, the fissure, when spread out, will usually reveal itself as an elliptical or diamond-shaped ulcer. Sometimes reflex symptoms such as urinary disturbances, sciatica, constipation, and intestinal distress may occur.

Treatment involves the prescription of a bland, non-irritating diet and the correction of constipation. Mineral oil to soften the stool is usually beneficial. Repeated cauterization of the ulcer with silver ni-

trate solution or a similar substance, after the ulcer area has been anesthetized may result in healing. Healing salves are frequently employed. Injections of anesthetics in oil into the base of the ulcer may by its prolonged anesthetic effect aid healing. In stubborn cases surgical excision of the ulcer area is often resorted to.

Rectal Fistula—A fistula is a passage which leads away from an abscess of the deeper tissues about the rectum and opens into the rectum near the anus. When the communication also leads into the urethra, it is referred to as *recto-urethral*; when it leads to the vagina, it is regarded as a *recto-vaginal fistula*. The fistulae may have one or two openings into the rectum proper, but openings leading to the mucosa or skin near the anus may be more numerous. A fistula leading to the outside of the anus is spoken of as *external*; to the inside, as *internal*. When a probe indicates that it leads from the anus to the deeper tissues but not into the inner rectum, it is regarded as a blind, incomplete fistula. When it leads from the anus into the inner rectum, it is spoken of as a complete rectal fistula. At times many passages lead from the inner rectum or deeper tissues near this organ toward the anus in semi-circular fashion; the fistula in this case is termed a *horseshoe fistula*.

The fistulae have their origin in an *abscess* or *infection* of the deeper tissues around the rectum, or in *bone lesions* involving the lower spine. When they do not open and drain properly upon the skin surface, they burrow their way in other directions, particularly toward the rectum as stated above. Some authorities regard many fistulae as *tuberculous* in origin, and a general examination of the patient is therefore important to rule out this infection.

The symptoms may be insignificant for years, the patient not knowing that a fistula exists so long as the infected tissues drain off through the unnoticed passage into the rectum. When drainage is interfered with, however, pain or discomfort will manifest itself after bowel movements or undue body activity. The pain or distress will be felt either in the anus, lower back, or other areas near by, depending upon the depth and extent of the fistula.

Examination of the anus and rectum will reveal one or more small openings, which may be traced with a thin metal probe to the point of origin through the fistulous passage. Pus will often be seen emerging from the openings of the fistulae. Some patients will complain of moisture about the anus, when the fistula leaks mucus or pus.

The treatment is directed toward cleaning up the abscess condition and healing the fistulous communications. At first medical measures

in the form of injections into the diseased passage should be tried. Various antiseptic solutions and healing agents may prove valuable. When a thorough medical effort at local healing has been indulged in without favorable result, then surgical opening and drainage of the fistulae should be resorted to. It is also important to give such general treatment as the welfare of the patient requires. If tuberculosis exists, this condition must be given primary consideration.

Rectal Abscess—Abscesses frequently occur in the tissues around the rectum. Often they open on the skin surface near the anus. These abscesses may result from infection of a small hair or skin gland, from an infection of the skin near the anus, from infection of a hemorrhoid, or from injury to the rectum. Another form of abscess more serious in character sometimes occurs higher up in the pelvis and is known as *pelvi-rectal abscess*. It probably results from infection high up in the rectal wall or from disease in other pelvic organs.

The symptoms, as in abscess anywhere within the body, will consist of fever, chills, headaches, and pain in the perineum (tissues about the rectum and anus), varying in degree and depending upon the location and depth of the abscess. Pain is often severe and interferes with proper activity. Examination may reveal extreme tenderness or swelling over the diseased area. If the abscess is near the skin, the surface tissue may be red, swollen, and warm to the touch. Such reflex symptoms as difficulty in urination, constipation, diarrhea, or rectal discomfort may assert themselves. If the abscess is high up in the rectum, the local symptoms are usually referred to a higher level and will not be seen at the skin surface.

Treatment in the early acute stages is directed toward allaying the inflammation with hot or cold compresses or hot sitz baths. In addition, medication should be given to reduce pain and fever. Unless the abscess ruptures to the outside surface, great pain and danger to the welfare of the patient may continue. To prevent needless suffering and to avoid dangerous complications, surgery directed toward opening and draining the abscess should be advocated.

Infections of the Rectum—Occasionally infections of the mucosa or lining of the rectum occur. They may be *specific*, the result of infections by definite germs known to produce certain types of inflammation, such as diphtheria, gonorrhea, syphilis, tuberculosis, and amoebic catarrh. Inflammations that cannot be ascribed to any specific germ are spoken of as *non-specific*.

The symptoms of all these inflammations, irrespective of the character of the infecting agent, resemble each other. Local soreness in

the rectum, pain in movement of the bowels, fever, chills, headache, and body soreness are common complaints. The victim may complain of constipation or diarrhea or both. The stool contains mucus, blood, or pus in accordance with the degree of inflammation. Examination of the rectum through the rectoscope will reveal the lesion characteristic of the inflammation, and smears made from the rectal wall as well as from portions of the bowel excrement often exhibit the germs or organisms which induce the respective diseases.

The treatment will depend upon the type of inflammation or disease present. Diphtheria would require diphtheria anti-toxin and such general measures as are indicated for this disease. Syphilis would require anti-syphilitic treatment, and gonorrhea, amoebic infection, and tuberculosis would need such attention as is known to benefit these conditions. Such local measures as irrigations or enemas containing solutions that are presumed to have a healing effect may be employed. Simple, bland, non-irritating foods should be ingested.

Papillitis and Cryptitis—Papillitis and cryptitis imply an inflammation of the small papillae (tissue protrusions) and crypts (depressions) respectively, which are normally seen surrounding the wall of the rectum at its lower end near the internal sphincter (inner shutter).

The symptoms are mild or sharp pain, or discomfort in the form of throbbing or burning in the region of the anus during or after bowel movement. Sometimes pain or discomfort is referred to the region of the bladder or the genital organs. Constipation and spastic pain in the anus are not uncommon symptoms. Examination of the rectum will reveal enlargement of the papillae and congestion of the crypts because of the inflammation, and the anus is quite sore to the touch. The treatment should aim at preventing constipation and at reducing the local inflammation. Ointments and suppositories consisting of anesthetic and healing medicaments are usually beneficial. At times the papillae should be removed by electro-cautery or surgery.

Stricture of the Rectum—Stricture of the rectum refers to a *narrowing* of the rectum, which may be *functional* or *organic* in nature. The former type is believed to be due to a *spasticity* of the muscle fibers within the wall surrounding the rectum; the latter results from *overgrowth* of muscle tissue within the rectal wall, from *tumors*, or from *inflammatory processes*. Some of these strictures are congenital in origin; others are acquired during life.

The symptoms usually begin as a slowly developing constipation alternating with diarrhea. Later on, pain or burning in the lower rectum may occur. Because of pronounced interference with the elimi-

nation of excrement and gas, abdominal distention and cramps occasionally occur, and because of the obstruction the stools when passed often assume a tape-like or pencil-form appearance. The stool may also contain mucus, pus, or blood. An examination of the rectum by means of the finger or the rectoscope will reveal the stricture.

The treatment will depend upon the degree of obstruction and upon the cause underlying its production. Inflammatory lesions must be healed first, and the constriction should be treated afterward by mechanical dilatation or stretching. This is accomplished with the finger or with a mechanical dilator. Other diseased conditions should be healed if possible, for through this a number of reflex constrictions are overcome. Surgery is sometimes necessary to relieve some strictures.

Prolapse of the Rectum—This condition implies a lowering of the rectum or a portion of it. There are two varieties, the *incomplete* and the *complete*.

The *incomplete* form is recognized by rectoscopic examination and only during straining may extrude to the outside beyond the anus. It is an invagination (ensheathing of the relaxed upper part of the rectum by the lower part) of the rectal mucosa (lining) which has resulted from a relaxation or loosening of the muscles and other tissues of the wall of the rectum. This may result from such causes as violent straining at stool, muscle weakness in elderly persons, and the presence of growths which, because of their size and weight, invite relaxation of the wall.

The *complete* form is readily recognized by its extrusion beyond the anus and is probably due to a relaxation or violent stretching of the ligaments which normally hold the rectum in position. It is very likely that the incomplete form precedes its development in most cases. Violent straining at stool and pressure from adjoining organs, such as the bladder and uterus, may induce its occurrence.

The treatment will, of course, involve the correction of the cause. Growths, if present, should be removed. Constipation should be corrected as far as possible, and straining at stool must be checked.

Excellent results have been obtained in a number of cases by injecting phenolized oil into the walls of the upper rectum, after having previously reduced the prolapse by manipulation with the fingers. This injected material has undoubtedly created a firm adherence between the rectal wall and the deeper underlying tissues. In complete prolapse which does not respond to these measures, surgery will necessarily become the treatment of choice.

Pruritus Ani—This condition is characterized by itching around

the anus and is quite prevalent. It may result from constipation, especially that form in which the rectum remains filled with excrement for long periods; or it may be associated with hemorrhoids, fissure, fistula, minor infections about the rectum or anus, and purely irritative disturbances affecting the nerves about the rectum and anus. In some cases it is possibly due to a skin infection either by the bacteria of the skin or by parasites.

Itching is the prominent symptom, which varies in intensity, extent, and duration. Scratching, to gain relief, is a common practice. When the itching is severe, the victim may, as a result, become quite nervous and be unable to sleep well. Examination of the tissues about the anus will reveal, in advanced cases, dry, thickened skin, at times shiny, with reduced growth of hair in the neighborhood, as well as deep furrows between radiating folds of skin pointing toward the anus.

The treatment will depend upon the correction of the cause, if that can be determined, as in instances of hemorrhoids, constipation, fissure, fistula, and cryptitis. Proper diets to avoid constipation and to offset allergic manifestations are indicated in some cases. If the person is of a nervous type, such medication and measures as will quiet this condition should be employed. Sometimes local ointments, dusting powders, and washes are used with benefit. In severe cases, injections of long-enduring local anesthetics are made into the tissues about the anus, to control the local irritability. Painting with dyes and other medicaments is frequently indulged in to subdue parasitic infections. Vaccine injections occasionally give relief. Alpine light therapy and local X-ray treatments are sometimes utilized. Some authorities have even resorted to tattooing the tissues about the anus in order to obtain relief for sufferers, and surgeons have attempted to destroy the nerves through local cutting procedures. The results in many cases have been good, in others again unsatisfactory.

CHAPTER XII

Diseases of the Liver and Bile Passages

Jaundice or Icterus—This condition implies a yellow discoloration of the skin of varying intensity and is due to an increase in the quantity of *bile pigment* and *bile salts* in the blood. The causes underlying its production are many and the nature of the jaundice will vary in different cases.

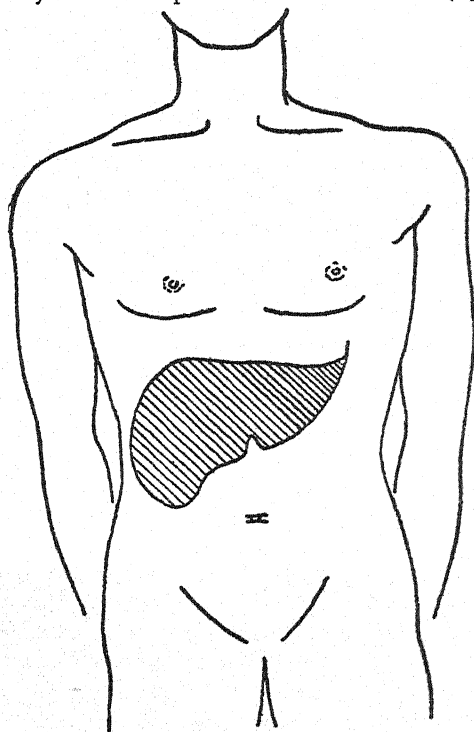
Catarrhal Icterus—Catarrhal icterus is regarded as the ordinary form, which comes on suddenly in persons who were previously well and runs its course in a few weeks. It is believed to be due to a simple *catarrhal inflammation* of the bile passages. It can occur because of indiscretions in the diet, exposure to inclement weather, mental irritation, and nervous influences, and possibly because of extension of disease from the stomach and intestines.

Febrile Icterus—Febrile icterus, also known as *epidemic catarrhal jaundice*, results from an infection by an organism known as the *spirochete nodosa*. In this type also the bile passages are affected; the jaundice may appear early or late, running its course in a few weeks.

The symptoms in both ailments are similar. Chills, fever, and digestive symptoms such as loss of appetite, nausea, vomiting, abdominal pain, and constipation, may be encountered. As the flow of bile from the common bile duct is reduced, jaundice gradually asserts itself, because of backward pressure and congestion within the liver and because of absorption of bile pigment and bile salts into the blood. The liver and spleen are usually enlarged, and the stool is clay-colored from lack of a proper quantity of bile and the presence of undigested fat in its content. Undigested fat is present, because of a diminution of the pancreatic secretion which normally digests fat and because of interference with its elimination through the swollen or congested bile duct. The skin is mildly or deeply jaundiced and at times itches considerably. The victim may feel drowsy, and hemorrhages may occur under the skin, in the lining of the mouth, and in the backgrounds

of the eyes. Other general symptoms such as malaise, weakness, and loss of weight also occur.

Obstructive Jaundice—Obstructive jaundice results from a *hindrance to the flow of bile* through the common bile duct into the intestine. Normally the bile empties into the duodenum (uppermost sec-



The dark shadow portrays the liver in its usual position in the upper abdomen, immediately under the diaphragm. The top of the liver attains a level in the chest approximating the lower ribs, and extends across the upper abdomen to the left nipple line.

tion of the small intestine). Any condition which hinders the elimination of the bile from its source in the liver through the common bile duct will cause the bile to become dammed up in the liver and in its bile ducts above the point of obstruction. As a result, secondary changes may occur in the liver cells, and bile will be absorbed into the blood, causing jaundice.

The conditions which cause an obstruction to the outflow of bile from the bile passages into the intestine are: inflammation of the bile ducts, foreign bodies or gall stones within the ducts, abscess or tumor pressing upon the ducts, pressure upon the bile passages from an enlarged or diseased organ near by, and disease at or near the outlet of the main common bile duct.

Other symptoms such as digestive complaints, clay-colored stools, weakness, and chills may all occur, with or without fever; but the course and outcome of the disease will depend upon the true nature of the obstruction.

Certain forms of jaundice which are more or less the result of obstruction to the outflow of bile from the liver through the bile ducts include: so-called *psychic jaundice*, some forms of *toxic jaundice*, *syphilitic jaundice*, *menstrual jaundice*, and *starvation jaundice*. In these various forms of jaundice, the immediate cause of the obstruction to bile outflow is either spasm of the common bile duct or smaller ducts, inflammation of these ducts, simple congestion of the lining of the bile ducts, loss of the contraction power of the muscle in the walls of the ducts, and congestion of the blood vessels supplying the liver and bile ducts.

A type of jaundice known as *hemolytic jaundice* and some forms of *toxic jaundice* are not due to obstruction to the outflow through the bile ducts, but the result of *destruction of the red blood cells* within the circulation, in consequence of which hemoglobin (coloring matter of the blood) is liberated. This hemoglobin is then probably transformed to a certain extent into *bilirubin*, a bile pigment. When the quantity of this bilirubin exceeds the normal level, jaundice will ensue. This form of jaundice is believed to originate in a disturbance or affliction of the blood-forming areas of the liver, spleen, or bone marrow. It is also likely that certain forms of toxic jaundice have their origin in the same areas, because of irritation by infective agents or toxins, and also following the use of such drugs as salvarsan, mercury, and coal-tar preparations.

The treatment of the various forms of jaundice naturally will depend upon the underlying cause. The *catarrhal* and *febrile* forms of jaundice usually run their course; when the congestion within the gall tract subsides, the symptoms gradually abate. Rest in bed is essential to bring about healing and avoidance of complications. Bland, simple food free from fat should be employed. Constipation should be corrected, and attempts to reduce the jaundice may be made through the use of medication or bile drainage. Fever and nervousness are relieved by various

medicines, and in the febrile form of the disease patients may be benefited by the use of a specific serum.

The various forms of *obstructive* jaundice are dependent for cure or improvement upon the eradication of the cause as far as possible. Bile drainage, a treatment described in a previous chapter, may be of great benefit in the form of jaundice due to inflammation of the ducts. Where pressure from adjoining organs or growths is the causative factor, surgery is frequently required.

Cholelithiasis (Gall Stones) and Cholecystitis (Inflammation of the Gall Bladder)—The gall bladder is a common seat of inflammation and of gall-stone formation. The symptoms in both conditions closely simulate one another.

Gall stones are believed to result from the damming up and concentration of bile in the gall bladder, in consequence of which bile salts or pigments sediment out; with these as a basis, stones may develop. Some authorities feel that a primary infection of the lining of the gall bladder predisposes to stone formation.

Individuals who lead sedentary lives are more disposed to gall-bladder diseases than are active people. It occurs more frequently in people who live in the temperate and colder climates or in those who are exposed to dampness and cold. It is often allied with pregnancy in women, in persons who tend toward gourmandism, and in persons who are afflicted with constipation.

Inflammation of the gall bladder manifests itself either as an *acute* or as a *chronic* process. The *acute* variety may occur as a *catarrhal* (congested) inflammation, a *membranous* inflammation (inflammatory secretion which consists of a network of fibrin embracing bile pigment, tissue cells, and debris), a *suppurative* inflammation (inflammatory process associated with pus formation), or a *gangrenous* process (advanced state of inflammation resulting in gangrene formation). The various products of inflammation—degenerative material, blood, or pus—will be found within the gall bladders of patients so affected. These acute inflammations arise as a result of infection carried to the gall bladder through the blood channels from other sources, as in cases of dysentery, typhoid, and pneumonia, or by direct extension to the gall tract from the intestine as in intestinal catarrh and constipation. Some of the germs capable of producing this type of inflammation are streptococci, pneumococci, and the colon and typhoid bacilli.

The *chronic* inflammation may follow in the wake of a previous acute process, or it may come on gradually over a period of time because of a *continued irritation* of the gall-bladder wall, either by

stones present in this organ, by pressure upon the gall bladder from adjoining organs, by extension of catarrh to the gall bladder from the intestinal tract, or by infection carried by the blood stream to this organ from another part of the body.

The symptoms of gall stones are negligible in some cases for many years, and the condition may not be recognized except through an accidental X-ray finding or during an operation upon the abdomen for another condition. In such instances the gall stones have not caused mechanical or inflammatory irritation. On the contrary, other cases may exhibit either mild digestive disturbances or symptoms of a severe character, such as nausea, belching, bloating, regurgitation, vomiting, and pain in the region of the stomach or over the liver and gall-bladder area (right upper abdomen). At times the pain is reflected to the right shoulder, to the back, to the precordium (heart area), or to other parts of the abdomen. In some cases the pain is severe and calls for the use of a hypodermic injection for relief. When, in addition to the presence of gall stones, the gall bladder is inflamed, there may also be fever, chills, headache, and achiness. A colicky attack of pain, confined to the stomach or over the liver area, occurring in a previously healthy person a few hours after a heavy meal is presumptive evidence of a gall-stone attack. Nausea and vomiting are usually associated symptoms. Jaundice will occasionally occur in a small percentage of these cases because of the blocking of the common duct by a stone or by reflex spasm of the main bile duct.

Examination of the abdomen will frequently elicit a certain degree of tenderness over the epigastrium (pit of stomach) or in the right upper quadrant of the abdomen. In severe cases this tenderness is more pronounced, and the muscles overlying these areas are tense or even rigid. At times the tenderness is reflected to the back of the right chest. The liver often may be felt because it is congested, and the gall bladder may be palpable to the examining fingers of the physician. X-ray illumination is one of the best means we have for the recognition of gall stones, especially since the use of a gall-bladder dye has been afforded us.

The symptoms of inflammation of the gall bladder may simulate in great measure the symptoms of gall stones. The milder the inflammation, the less intense are the symptoms; the more severe the degree of inflammation, the more pronounced the symptoms. Chills, fever, and pain are the usual manifestations, in addition to the various symptoms of indigestion and local tenderness as already described under the head of gall stones. Jaundice is an occasional complication,

in which case the stool is clay-colored and the urine exceedingly dark because of the presence of bile. Examination of the abdomen may reveal tenderness, an enlarged gall bladder, and a swollen liver, as often found also in cases of gall stones.

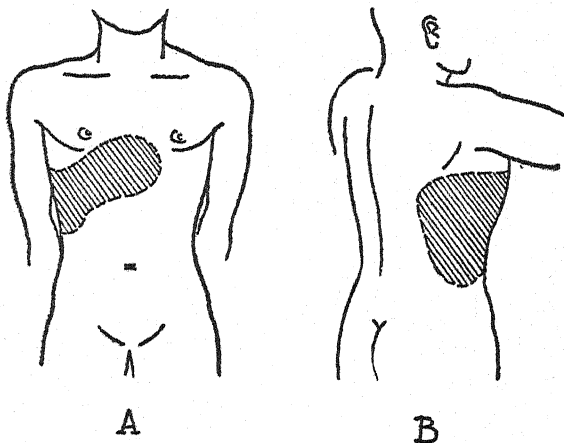
An X-ray examination with the use of the so-called gall-bladder dyes will afford valuable information regarding the condition of the gall bladder. If the gall bladder does not produce a shadow fifteen or more hours after the dye has been taken, disease is probable in either the gall bladder or the gall-bladder duct. If it fills out improperly, gall-bladder disease may also be suspected. If it fails to empty adequately after certain foods are eaten, this may be due to a poorly functioning gall bladder, the result of disease. If the gall-bladder shadow is located in an abnormal position or if its outline is deformed, probable disease is suggested. A gall stone, either calcified or uncalcified (containing no lime deposit), is sometimes seen in the cavity of a diseased gall bladder. Thus abnormalities in the size, shape, position, filling, and emptying of the gall bladder are portrayed by the X ray.

The treatment of both gall stones and gall-bladder inflammation are similar. Variations will depend to a certain extent upon the severity of the diseased process and the extent of such complications as jaundice, obstruction of the common bile duct, and peritonitis.

Persons who wish to avoid gall-bladder disease should not lead a too sedentary life, or indulge in rich food and indiscriminate eating or drinking. They should take moderate, regulated exercise, avoid constipation, and eat simple foods not too high in fat, starch, or sugar content. The best foods are vegetables and lean meats or other lean protein foods.

Once gall-bladder disease exists, its treatment will vary with the predominating symptoms. Mild pain is frequently controlled by dietary regulation and anti-spasmodic medication. Severe pain usually requires hypodermic injections and other forms of treatment by the mouth. Gall-bladder inflammation may be benefited by the use of bile-tract disinfectants and of stimulants of the bile flow to prevent or overcome stasis or congestion within the gall bladder. Frequently so-called bile-drainage treatment through the use of a duodenal tube serves a helpful purpose. Cathartics and laxatives to overcome constipation may prove of value. Occasionally persistent intestinal irrigation has a wholesome effect, as has diathermy or short-wave therapy applied over the liver and gall-bladder areas. Some students of the subject have expressed confidence in the value of vaccines to combat

infections within the liver and bile tract. Salines and mineral waters aid many people, as attested by the results attained at various mineral spring resorts. In acute cases, rest in bed is ordinarily required for some time, but chronic cases do not need much rest in bed. Finally, if all possible medical measures have been properly applied and failed,



A—a view of the liver from the front.

B—a view of the liver from the right side.

surgery may be required to give relief and to prevent complications.

Circulatory Disorders of the Liver—Two types of disturbance may occur: *active hyperemia* (congestion) and *passive hyperemia*.

Active congestion of the liver is due to an increase in the forward supply of blood to this organ. *Passive* congestion results from a damming up of blood in this organ because of a hindrance in its outflow.

Active hyperemia occurs in persons who are not active and who lead quiet, *sedentary* lives. It is sometimes attributed to excessive drinking of liquor and indiscretions in the diet, especially the taking of spiced and irritating foods. In individuals who have had infections such as influenza, typhoid, or malaria, and in persons afflicted with high blood pressure, this form of liver congestion may occasionally develop.

The passive form of hyperemia will usually occur in individuals suffering from heart disease or some disorder in the blood circulation. These effects upon the heart and circulation may also result from disorders in the lungs, kidneys, and other visceral organs. Because of a damming up of blood from the heart in the veins of the liver, the

latter organ becomes congested and on account of its appearance at autopsy is called a *nutmeg liver*.

The symptoms of active congestion of the liver simulate what is often regarded as *biliousness*. It usually comes on after excessive drinking or eating, and gives rise to some of the following symptoms: coated tongue, poor appetite, foul taste, headache, nausea, vomiting, constipation or diarrhea, dizziness, depression, insomnia, and sometimes pain in the pit of the stomach or over the liver region. Occasionally there is a slight jaundice and light-colored stools.

The symptoms of passive congestion of the liver will usually come on gradually in persons who had previously suffered from heart or circulatory disturbances. Symptoms similar to those mentioned above under active hyperemia may gradually develop as the congestion becomes more advanced, and in severe cases the skin assumes a bluish as well as a mildly jaundiced color. When obstruction to the outflow of blood from the liver becomes pronounced, *ascites* (excessive fluid in the abdomen) or *edema* (dropsical fluid accumulation) of the legs may occur. The physician in such cases will find the liver definitely enlarged and usually tender to the touch. Pulsation of the liver is at times felt by the examining hand to synchronize with the heart beat. Individuals with this type of congestion often have marked varicose veins in the lower limbs, and hemorrhoids. Blood tests will reveal toxic elements and bile products indicative of liver disorder, and the urine may likewise elicit similar findings.

The treatment of these circulatory disorders will depend upon the underlying cause, which should be corrected as far as possible. Abstinence from all forms of liquor, stimulating beverages, and irritating foods must be adhered to. Fatty, rich, and spiced foods are interdicted. Milk, vegetables, cereals, and stewed fruits should be well tolerated by most of these patients. Lean fish and lean fowl, preferably white meat, is the best form of protein food to eat. Sugars in the form of lactose and glucose are of benefit, but must be given appetizingly.

Medical treatment is directed toward improving the congestion of the liver and of the circulation generally. Local applications over the liver to relieve pain and medication to produce general relief are procedures usually followed. Outstanding symptoms must be treated and the general condition of the patient thoroughly observed. Rest in bed is necessary during the acute manifestations of the disease.

Cirrhosis of the Liver—This condition is characterized by an *overgrowth of liver tissue* and occurs in a number of forms. It is believed

to be due to an irritation or infection of the liver tissue arising from one of many causes.

The form of cirrhosis known as *Laennec's* is usually the result of *alcoholic irritation* and occurs in heavy drinkers of strong liquor. It also occurs in individuals suffering from such *infections* as typhoid, malaria, and tuberculosis and in persons who have indulged in *spicy foods* over many years or who have absorbed quantities of arsenic, mercury, lead, or phosphorus. The liver is much enlarged in the early stages of the disease, but shrinks in the later stages and becomes hard and nodular.

The form of cirrhosis known as *Hanot's* is structurally different and occurs in two main types, the *primary* and the *secondary*. The first originates as an inflammation within the *small bile ducts* of the liver; the second results from an *extension* of the inflammation in the gall bladder and common bile duct to the smaller ducts in the liver. The bile-duct inflammation within the liver is believed to be due to the influence of toxic irritation and pressure by the dammed-up bile fluid. This condition is not the result of alcoholic irritation, but rather the result of extension of infection or congestion from the stomach, bowels, and gall bladder. It is also possible that the infection of the liver ducts may follow as a result of extension via the blood channels. The *spleen* also is usually enlarged in this disease. Because of the enlargements, the liver and spleen are readily felt by the examining hands of the physician.

The symptoms of these various forms of cirrhosis of the liver are much alike. The onset is usually slow and insidious, over a period of months or years. The early stages present few if any symptoms of indigestion, such as loss of appetite, belching, bloating, nausea, vomiting, and mild pain over the pit of the stomach or liver area. As time goes on, such additional symptoms as diarrhea or constipation and aggravation of pain over the stomach, liver, and other regions of the abdomen may occur. Finally a mild jaundice with or without itching of the skin may take place, particularly in Hanot's disease, and hemorrhages may arise from the nose, gums, kidneys, and rectum because of a congestion of the veins in these areas. In the advanced stages of the disease, the abdomen may become ascitic (filled with fluid). This is more likely to occur in Laennec's cirrhosis than in Hanot's. The lower limbs may also become edematous (laden with fluid).

The liver is usually readily felt in both types of the disease, but in the advanced stage of Laennec's it may shrink to such a degree as to be lost to the examining hand. The liver in Laennec's disease, when

felt, is more nodular and irregular than in Hanot's. Enlarged, dilated veins are frequently seen under the skin overlying the upper abdomen. The urine, through evidence of the presence of bile products, indicates the existence of a poorly functioning liver. The kidney, because of the existing toxemia, may undergo irritation, as indicated by the presence of abnormal substances in the urine. The blood will usually evince a secondary anemia. Loss of weight and pronounced weakness supervene as time goes on. The disease runs either a rapid or a prolonged course, usually more protracted in Hanot's than in Laennec's.

The treatment is especially directed toward reducing the irritation of the liver, and a non-irritating easily digestible diet is prescribed. Plenty of nutritive foods such as milk, buttermilk, junket, mild milk soups, fruits, and non-starchy vegetables are important parts of the diet in this ailment. Rich, fatty, and too starchy foods must be avoided as far as possible. The white meat of chicken and the fat-free fishes are advocated as the condition improves, as are other lean meats, thin cereals, and eggs in due time. The digestive symptoms should be combated by either alkalies, acids, or bitter tonics, depending upon the nature of the stomach chemistry as determined by the physician. Constipation or diarrhea must be relieved, and such medication as the predominant symptoms demand should be administered. Medicine to relieve dropsy is necessarily given either by the mouth or by injection. Rest in bed should be insisted upon in some cases with moderate, mild exercise in between. Wherever possible, the underlying causes should be sought for and efforts at correction attempted.

Acute Parenchymatous Hepatitis—Acute parenchymatous hepatitis is a condition characterized by *inflammation of the cells of the liver*. As a result the liver is usually enlarged and soft. The inflammation is either mild or pronounced. The process may result from irritation of the liver following infections, such as pneumonia, typhoid, or malaria, and as a result of poisoning, alcoholism, and the indiscreet use of irritating foods.

The symptoms develop either suddenly or gradually over a period of weeks or months. Indigestion in the form of nausea, vomiting, loss of appetite, and thirst is a common complaint. Chilliness is a frequent symptom, and the temperature may range from a mild to a moderate degree. Headache, nervousness, mental depression, and insomnia also develop in the course of the disease. Mild jaundice may occur, and the urine will exhibit excessive bile elements in its content. The bowels often are loose and exhibit fermentation.

Treatment involves rest in bed, avoidance of irritating foods, and such measures as will tend to relieve liver congestion. Medication is indicated to correct prominent symptoms, as are supportive measures to prevent collapse and sustain nutrition. Prophylactic treatment involves avoidance of indiscretions in eating and drinking and of exposure to inclement weather and infections.

Chronic Perihepatitis—This rare condition, because of the appearance of the liver at autopsy, is spoken of as *sugar-iced liver*. The liver is embraced by a firm, glistening, whitish covering of considerable thickness, the result of an inflammation of the connective tissue which covers this organ. *Alcoholism* and *dietary indiscretions* are believed to contribute to its production, but *infections* and *arteriosclerosis* are regarded as more likely causes. Some authorities feel that such chronic diseases as rheumatism, syphilis, kidney disease, gout, malaria, and tuberculosis play an important role.

The symptoms are negligible at the onset of the illness, which establishes itself insidiously over a period of years. Usually, after the disease has fully developed, such symptoms as mild indigestion, abdominal distention, and sensations of discomfort or mild pain in the epigastrium (stomach pit) and right hypochondrium (liver area) will manifest themselves. As the condition progresses, ascites (fluid in the abdomen) and edema (fluid) in the lower limbs may develop. Evidence of kidney disease and heart or circulatory disorders may arise to complicate the picture. The liver is often felt by the examining physician as a thickened, smooth organ, rather tender to the touch. In some respects it simulates one of the forms of liver cirrhosis.

The diet should be bland, nutritious, and easily digestible. As in cirrhosis, all irritating and spicy foods as well as alcoholic beverages should be avoided. Symptoms which demand attention must be first treated, and such medication utilized as is warranted. The treatment is somewhat similar to that prescribed for the liver cirrhoses.

Acute Yellow Atrophy of the Liver—Acute yellow atrophy of the liver is a condition characterized by widespread *destruction of the liver substance*, and one in which the liver is colored either a deep yellow or a brownish yellow. It is believed that the process is inflammatory or degenerative in character and results eventually in the destruction of the secreting cells of the liver. The destruction of the cells takes place either because of an infection or because of auto-digestion produced by ferments resident within the liver itself. Because of this destruction of its cells, the liver undergoes rapid reduction in size, or atrophy, and, since the cells no longer eliminate bile

pigment, this material is absorbed into the blood and produces jaundice.

This ailment is believed to be *toxic* or *infectious* in origin. *Toxic* factors may originate either from within the digestive system because of poisons created from improper digestion of food products, as in intestinal diseases and pregnancy, or as the result of poisonous foods (ptomaines) or toxic medication taken directly into the body (ether, chloroform, arsenic, mercury, etc.). *Infectious* processes which create this liver condition may originate in such ailments as typhoid, influenza, and syphilis. The infection may also extend to the liver from disorders within the stomach, bowels, and gall tract.

The symptoms usually develop as a mild digestive disorder, with loss of appetite, nausea, vomiting, constipation, slight temperature, headache, achiness in the body, and pain in the epigastrium or right upper abdomen. Jaundice occurs after a few days. As time goes on, the condition ordinarily gets worse, as indicated by intensification of the jaundice, increase in temperature, pronounced vomiting, and weakness. Hemorrhages from the nose, the kidneys, and other parts of the body may occur. The urine contains bile, and such symptoms of auto-intoxication as headaches, malaise, muscular twitching, spasm or muscular paralysis of certain muscles, delirium, stupor, and coma frequently arise. The disease may run a course varying from days to months.

In the early stages of the disease the liver may be enlarged, but as the ailment progresses the liver is reduced in size. The spleen also is enlarged and may be felt at times during the course of the disease. Owing to improper liver function, the blood, upon examination, reveals the presence of abnormal products in its make-up.

The treatment will depend upon the underlying cause of the disorder. Rest in bed and proper diet are essential. Avoidance of fatty foods is imperative. Bland food consisting of milk, buttermilk, cereal gruels, and sugars is to be utilized, with alkali drinks to counteract acidosis. Nerve sedatives to control nervous irritability, supportive medication, and all such other measures as aim to correct disturbing symptoms are to be made use of.

Suppurative Hepatitis or Liver Abscess—Suppurative hepatitis or liver abscess is a condition manifesting itself occasionally; it results from infection brought to the liver either through the *blood stream* or by *direct extension* into the gall ducts. Infection by the former route arises from infection of the surface of the body as in erysipelas and smallpox or following injuries of the skin, or infection from diseases

of the intestines as in typhoid, dysentery, ulcerative colitis, tuberculosis, appendicitis, and other abdominal inflammations. Infection by the latter route may occur in diseases of the upper intestine, gall bladder, and gall ducts.

The symptoms will depend upon the extent of the liver involvement and the origin of the infection. The condition is usually ushered in with a chill, sweats, and fever. This last symptom ordinarily runs an up-and-down course, which is referred to as a *hectic curve*. When the infection arises from the gall tract or intestines, the symptoms are somewhat complicated by digestive manifestations. Pain is generally felt over the region of the liver, and varies from a mild to a pronounced degree, but it may also be reflected to other portions of the abdomen as well as to the chest and right shoulder. The liver, because of its enlargement, may encroach upon the diaphragm (muscle partition separating chest from abdomen) and cause impeding of the respiration, hiccoughs, difficulty in swallowing, or reflex coughing. Occasionally jaundice occurs and the general health is much impaired. The examining physician will often be able to detect an enlarged tender liver.

The treatment will depend upon the nature of the underlying infection. Naturally, when the source of infection is tropical dysentery, typhoid, or malaria, these diseases require special attention. General hygiene, proper diet, rest in bed, and such measures are essential, and in some instances vaccines are of value. When possible, however, surgical evacuation and drainage of the abscess should be instituted.

Thrombosis of the Liver Circulation—This usually implies the involvement of the *large portal vein* or its branches. In addition, neighboring vessels such as the *mesenteric veins* or the veins which supply the *spleen* may also be affected by the process of blood clotting, which involves the lumen of these vessels. This is occasioned either by some mechanical effect or compression, or by some influence wrought upon the walls of these veins through such diseased conditions as infections, cirrhosis (overgrowth and hardening of the tissue), toxic factors, syphilis, and conditions retarding the rate of the blood circulation. As time progresses, the *thrombus* or *clot* which is formed within the lumen of a vein undergoes organization (healing through new-tissue formation), and other smaller new veins develop to replace the defective vessel. These newly formed vessels are referred to under the term "establishment of a collateral circulation." The degree of healing will depend upon the adequacy of the collateral circulation.

The symptoms of thrombosis of the venous supply of the liver or neighboring organs will be dependent upon the location of the clot

and upon how much interference it has produced in the circulation. In mild cases the symptoms will be less pronounced, and in severe cases the symptoms may be strongly marked. When the circulation is profoundly impeded, the backward stagnation of blood in the liver, spleen, and other digestive organs may produce an enlargement and swelling of these viscera. Symptoms which are the result of circulatory stasis in these organs will develop; these are the various manifestations of indigestion, pain in the epigastrium (pit of stomach), pain over the liver region, pain referred to the back and shoulders, the vomiting of blood, the passing of blood in the stool, secondary anemia, mild jaundice, and the occurrence of ascites (dropsical accumulation of fluid in the abdomen) and edema (fluid in the lower limbs). With improvement of the collateral circulation, these symptoms may subside completely or recur when a new thrombus develops. The liver and spleen are often found to be enlarged, and hemorrhoids are a prominent complication.

The treatment, in addition to proper rest and dietary restriction to bland, non-irritating foods, is more or less symptomatic and in great measure parallels the treatment advised above for cirrhosis of the liver.

Pylephlebitis of the Liver Circulation—This condition is characterized by a purulent (pus) inflammation of the small branches of the *veins of the liver*, and is the result of an infection of the vessel wall. The lumen of the vein is usually filled with infected thrombotic (clotty) material which may be the source of distribution of emboli (plugs of clotty material) throughout the liver and other organs. This disease within the liver follows infections within other organs, such as appendicitis, ulcerative colitis, abscess of any visceral organ, and inflammation of the gall bladder or bile ducts.

The symptoms will depend upon the nature and extent of the inflammation in the liver veins. Pain in the epigastrium and over the liver is a common complaint which varies in intensity. It may be referred to other parts of the abdomen, the back and right shoulder. The liver and spleen are often enlarged and tender to the touch, and jaundice may occur. Chills and fever usually occur as in all infections, but vary in severity depending on the nature of the infection. Sweating, languor, drowsiness, and delirium may occur. The stool is frequently constipative or diarrhetic in nature, and at times contains blood. The blood, upon culture, may evidence the presence of certain infectious organisms such as streptococci.

The treatment will chiefly embody attempts at annihilating the

infection. This is now accomplished through the use of the sulfa drugs and penicillin. As a result of such medication, this disease, pylephlebitis, which formerly was so often fatal, may possibly be cured. In addition, proper rest and restriction to simple bland foods are essential. Such other measures as appear necessary should be employed to correct symptoms.

Echinococcus Cysts of the Liver, or Hydatids—This ailment occurs in people who live in close contact with such favorite animals as dogs, and is therefore not uncommon in such lands as Iceland and Australia. The disease is due to an infection by a tapeworm known as *Taenia echinococcus*, which usually inhabits the intestinal canal of the dog. The hind portion of the tapeworm contains numerous ova (eggs) which separate from the main part of the worm and are discharged in the feces. When these ova contaminate water or food, the infection is carried into the body and enters the circulation through the liver and intestinal tract, finally reaching such other organs as the lungs, heart, kidneys, brain, and spleen. These eggs develop into large cysts (sacs), within a few months or over a period of years, and are called *hydatid cysts*.

The symptoms come on slowly and often only after the disease has noticeably developed. It is usually recognized during the course of an examination for some other apparently irrelevant complaint. The symptoms develop after the cysts have enlarged sufficiently to exert pressure within the liver and cause stretching of the liver capsule (covering). When the pressure is upward against the diaphragm or lungs, respiration may be impeded; when the pressure is downward into the abdomen, encroachment upon the abdominal organs may cause pain in the direction of greatest tension. When the pressure is expressed in great degree against the circulation of the liver or upon the bile ducts, such symptoms as ascites (fluid in the abdomen) and jaundice (yellow discoloration of the skin due to bile entering the blood circulation) occur. The general condition of the victim is usually good unless a complication such as peritonitis develops following the rupture of a cyst.

The abdomen, upon examination, will usually reveal a large, smooth, painless mass in the liver area; this may feel elastic or suggest the fluctuation of fluid within its confines. The liver area is occasionally slightly tender, but more often only a sense of fullness or pressure is felt by the patient over this region.

Studies from other angles and a careful history of the case will aid in the recognition of this condition, which might otherwise be con-

fused with other diseases characterized by liver enlargement. In rare instances the condition cures itself through the death of the parasite, in consequence of which the large cystic mass undergoes degeneration or calcification (hardening through lime deposits). As already stated, the mass may rupture and invade other organs and tissues, causing the condition to become aggravated or even fatal.

The treatment is usually surgical, aiming at the eradication of the disease. Prophylactic treatment embodies the principle of avoiding intimate companionship with dogs, and protecting the food and water supply in those localities where the infection is known to prevail.

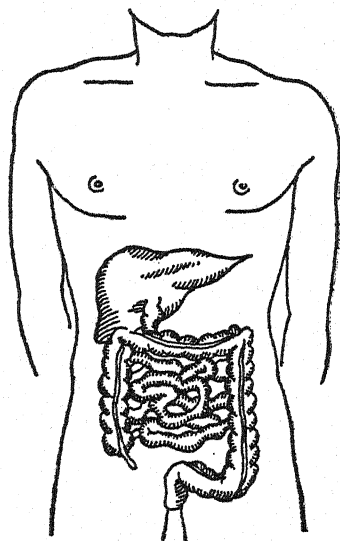
Syphilis of the Liver—This condition is either *congenital* or *acquired*, and is due to infection with the syphilitic germ known as the spirochete pallida. The liver in both forms of the disease is usually enlarged, but may also at times become small and nodular because of tissue contraction in advanced stages of the disease.

The *congenital* form of the disease will be recognized in the early years of life from birth to young adult age. The symptoms are usually mild or insignificant, but other general signs of syphilis may be noted. With the advance of the disease, pressure upon the liver vessels and gall ducts will produce *ascites* (dropsy or fluid in the abdomen) and *jaundice* (yellow discoloration of the skin).

The acquired form of the disease will be seen during adult life. The symptoms will be either insignificant or pronounced depending upon the degree of liver involvement. The symptoms often simulate those seen in cases of liver cirrhosis, in which various manifestations of indigestion occur. Jaundice is also a common finding in this disease, and ascites may occur when pressure upon the vessels becomes pronounced. Occasionally an increase in temperature accompanies the condition for a period of time. The symptoms indicating liver involvement usually occur a few years after the primary infection took place, and the condition may exist for years before it is controlled. Examination of the abdomen will usually reveal a definite enlargement of the liver, smooth or irregular in outline. Upon pressure, this organ is usually tender. The spleen also is frequently found to be enlarged, and because of pressure upon the blood vessels in the liver the various digestive organs may become congested, in consequence of which bleeding may occur in the stomach and intestines. As a result, blood often is vomited or passed in the stool. A thorough history of the case and a positive Wassermann test of the blood will aid in the establishment of the diagnosis.

The treatment will demand a proper recognition of the stage of

the disease, or how far advanced it is, and of the existence of complications. When the heart, kidneys, or circulation are involved, it is necessary that these organs be properly treated. Advanced cases of the disease, in which the liver has sustained great damage, may not re-



Showing the liver in relation to the colon (large intestine). The liver lies just above the hepatic flexure of the colon. The colon begins in the right lower quadrant and extends upward toward the liver, where it turns at the hepatic flexure to run across the abdomen toward the splenic flexure; here it turns to descend, as the descending colon and sigmoid flexure, into the rectum.

spond to treatment as satisfactorily as mild cases. Anti-syphilitic medication such as salvarsan, mercury, iodine, and bismuth should prove of great value in this disease. More recently a new drug, penicillin, has been produced which offers great hope in the future for the treatment of this ailment. Other medicaments to correct symptoms are also indicated in the treatment of this disease.

Cancer of the Liver and Gall Tract—Cancer occasionally arises in the gall bladder or larger gall ducts and in that case is believed to be due to *previous disease* in these organs, such as cholelithiasis (gall stones), cholecystitis (gall-bladder inflammation or catarrh), and choledochitis (gall-duct catarrh). Some authorities believe that the

wearing of tight corsets predisposes to catarrh and congestion in these organs, which later may invite the development of cancer. The liver itself may be the starting point for a cancerous process which is believed to follow in the wake of some earlier disease affecting this organ, such as liver cirrhosis, already described. Cancer may affect the liver *in spots*, or *diffusely* involve a large part of the organ. It may originate in the true liver cells or in the small gall ducts which pervade the liver. More commonly, however, cancer of the liver appears as a *secondary process*, the disease having metastasized (spread) to it from some other source such as the stomach, intestines, pancreas, gall bladder, lungs, kidneys, prostate, and ovaries. The growth usually involves the liver to a considerable extent, as a result of which the organ is definitely enlarged.

The symptoms will depend upon the degree of liver involvement and the duration of the process. Such symptoms of indigestion as anorexia (loss of appetite), nausea, vomiting, and pain over the epigastrium and liver are common. In addition, jaundice, skin dryness, itching, emaciation (loss of flesh), loss of weight and strength, and pain reflected to the right shoulder or chest will usually occur. The stool is often light or clay-colored because of the absence of bile or the presence of undigested fat. The urine usually contains bile, and the blood will evidence a so-called secondary anemia. The liver, during examination of the abdomen, is found to be enlarged and usually presents one or more enlargements (nodules) on its surface or edge. At times it is merely enlarged and hard to the touch. In advanced cases, pressure upon the circulation of the liver may cause an accumulation of fluid in the abdomen (dropsy) and difficulty in breathing due to upward pressure against the diaphragm (partition separating the chest from the abdomen). The glands in the groin and neck may become enlarged, denoting a spread of the disease to these parts.

The treatment is chiefly symptomatic and palliative. The diet should consist of readily digestible nutritious food, free from fat and cream. Cereals, fruits, jellies, milk, and other simple bland foods are indicated. Special efforts should be made to relieve pain and to eliminate dropsy. Surgery may be attempted if the disease is not too far advanced and has not already invaded the liver, as in cases of early primary cancer of the gall bladder.

Tuberculosis of the Liver—This disease usually occurs as a *secondary affection* following its primary inception in such organs as the lungs, the intestines, or the kidneys. The infection with the tubercle bacillus may occur through the blood stream or by direct extension from an

abdominal organ. The disease may occur in either the *miliary* or the *solitary* form. The former manifests itself in the liver as *small tubercles* (enlargements of pinhead size), studded throughout this organ; the latter appears as *larger tubercles* (enlargements of pea to egg size) in the spaces between the lobules (subdivisions of the liver). These tubercles may soften or degenerate and undergo abscess formation.

The symptoms will chiefly originate from the organ primarily affected, such as the lungs or the intestines. When the liver becomes affected, however, such additional symptoms as are characteristic of involvement of this organ also occur; these are achiness or pain over the liver area, jaundice, signs of indigestion, and abdominal ascites (dropsy). The liver may be found to be enlarged and tender during the abdominal examination. When an abscess occurs in the liver because of the degeneration of tuberculous foci, the symptoms will probably become aggravated, and fever or pain is likely to be increased.

The treatment is usually symptomatic and palliative. Simple, nutritious, bland foods are indicated, and such general measures as contribute toward improving the welfare of the patient should be employed. Abscess formation usually warrants the institution of surgery for relief and healing.

Hepatoptosis—The name implies a prolapse (dropping) of the liver, and the condition is frequently referred to as a *wandering liver*. It may be *congenital* in origin and thus associated with visceroptosis, a condition in which most of the visceral organs assume a low position in the abdomen, or it may have been *acquired* during life through stretching or lengthening of the ligaments which ordinarily support the liver. This effect upon the ligaments of the liver may result from frequent pregnancies, from the wearing of tight corsets, from severe and prolonged constipation, and from violent bodily injuries.

The symptoms usually refer to the digestive tract and are nausea, heartburn, distention, vomiting, and degrees of pain varying from a mild distress to genuine colic. In addition, because of the tugging upon the diaphragm, blood vessels, and liver ducts, other symptoms may arise; these are cough, dyspnea (shortness of breath), jaundice, ascites (fluid in the abdomen), hemorrhage (bleeding) within the stomach or bowels, and diarrhea or constipation.

The physician, upon examining the abdomen, will usually find the liver quite movable and easy to grasp with the examining fingers. Occasionally the organ may be shoved about the abdomen with ease and little discomfort to the patient. When visceroptosis exists, other organs such as the spleen, kidneys, and intestines may also be felt.

The treatment is directed chiefly toward supporting the liver by the application of a special abdominal belt which contains a pad that fits snugly and exerts pressure upward under the liver. In addition, a proper and easily assimilable diet is prescribed, and such other medication to correct symptoms as appears warranted. Mild exercises and massage to improve the tone of the body muscles, particularly the abdominal muscles, are usual indications. In rare instances surgery is resorted to in an attempt to restore the liver to a more normal position and to relieve symptoms.

Liver Enlargements—The liver is occasionally enlarged in conditions not already described in this chapter. Such ailments are comparatively rare, but nevertheless they do occur.

The condition known as *primary hypertrophy* of the liver, in which this organ is uniformly enlarged through the *overgrowth of its tissue substance*, may or may not produce symptoms. The cause for this overgrowth of tissue is unknown. This process is not to be confused with liver enlargements of a secondary nature which occur in the course of other diseases such as malaria, diabetes, and leukemia. This primary liver hypertrophy is often first recognized by the physician during the course of a physical examination and not ordinarily regarded as a serious ailment.

The condition referred to as *fatty liver* is marked by a general *distribution of fat* throughout the liver, as a result of which this organ is enlarged and doughy to the touch. It occurs in all types of persons whether of thin, fat, or medium build. The exact cause for its production is unknown, but it is assumed to be due to a *disturbance in body metabolism* (process of wear and tear), in consequence of which the liver cells function improperly. It is seen occasionally in individuals addicted to alcoholism and in those suffering from debilitating diseases such as tuberculosis, syphilis, and diabetes. Patients in this condition have few if any symptoms, and the finding of an enlarged liver by the physician during the course of a physical examination is usually the first intimation the patient has of its existence. The treatment will depend upon the recognition of a cause and an attempt at its correction.

The condition spoken of as *amyloid liver* implies a degeneration of liver tissue characterized by the depositing of *glucoprotein within the cells* comprising the liver substance. This glucoprotein material consists of a compound of carbohydrate and protein. The liver manifestation is usually a part of a general process affecting other organs of the body, such as the spleen, kidneys, and intestines. It is an occasional

complication of such chronic invalidating diseases as tuberculosis, syphilis, and intestinal disorders.

The symptoms will be influenced not only by the liver condition, but by the process as it involves other organs, as well as by whatever underlying disease may exist, such as tuberculosis or syphilis. When the kidneys are involved, the urine test will show considerable albumen, and when the intestines are affected diarrhea will probably be a prominent symptom. During the course of an abdominal examination, the liver is usually found to be greatly enlarged along with enlargements of the spleen or kidneys.

The treatment will involve attention to any underlying disease as well as regard for troublesome outstanding symptoms.

Occasionally a condition known as *atrophy of the liver* exists; the name denotes a wasting or shrinking of this organ. It is often a manifestation of old age, but it also occurs in starvation. It may also be due to pressure upon the liver blood vessels, in consequence of which the nutritive supply to the liver substance is diminished. At times the cells of the liver become deeply colored with a brownish pigment; this condition is referred to as *brown liver atrophy*. Another form of liver atrophy believed to be due to the wearing of tight corsets, as a result of which pressure effects upon the liver occur, is referred to as *liver constriction* or *furrowing*. The furrows or depressions often known to exist upon the liver surface are due to the constant pressure of the ribs or diaphragm upon this organ over a period of years. This condition is usually found in old women. The mild form evinces few if any signs, but the advanced cases may exhibit rather distressing symptoms.

The symptoms will depend upon the degree of atrophy or shrinking, and may in a measure correspond to those described under atrophic cirrhosis already discussed in this chapter. In some cases indigestion will be a prominent complaint, or the stool will be light yellow in color because of a poor elaboration of bile by the liver. The physician may, by percussion of the liver (study of tissue density by tapping the fingers over the liver area), elicit the fact that this organ is definitely diminished in size, and by X-ray examination he may confirm this finding. In those cases referred to as furrowing or constriction of the liver, the sensation of dragging or pressing in the liver region may assume prominence. When the wall of the abdomen is thin, the liver with its furrows is occasionally felt by the examining hand.

The treatment is usually symptomatic and also aims at the correction of liver function, the relief of pressure effects, and the improvement of nutrition generally.

CHAPTER XIII

Diseases of the Pancreas

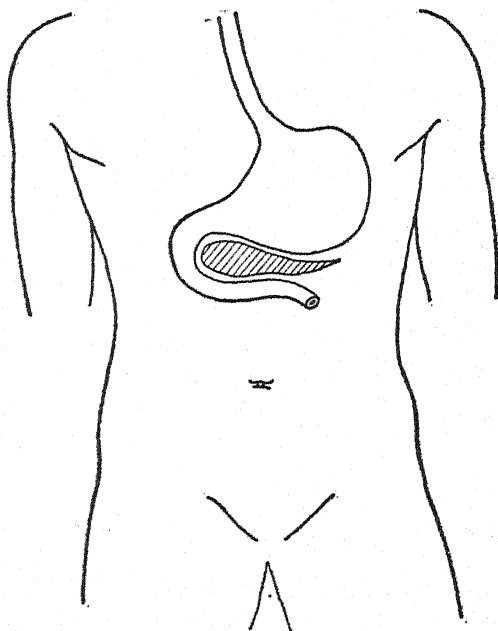
Pancreatitis—This condition results from inflammation of the pancreas (sweetbread) and may occur in three main forms: the first, resulting from acute inflammation alone and called *acute pancreatitis*; the second, associated with the development of hemorrhages within the pancreas and called *acute hemorrhagic pancreatitis*; and the third, known as *chronic pancreatitis*.

Acute pancreatitis will occur through infection which has been transmitted to the pancreas either by way of the *blood stream* or *lymph channels* as in malaria and influenza, or by *direct extension* from near-by inflammations as in diseases of the gall bladder, gall ducts, and uppermost intestine. As a result of this infection the entire organ may become inflamed and swollen.

Acute hemorrhagic pancreatitis is believed to be due to the digestive influence of the *ferments* of the pancreas upon the tissue substance of the pancreas itself. This results from a disturbance in the quantitative production or qualitative nature of the pancreatic secretion, or because of backward pressure of the secretion within the organ itself due to a blockade of the ducts which normally carry the secretion off to the intestine. The latter effect occurs in cases of obstruction of the pancreatic ducts because of catarrhal inflammation or blockade by a stone. The same effect may sometimes occur because of a stone in the common bile duct, as a result of which the pancreatic secretion and bile are dammed up in the pancreas. Extension of infection into the pancreatic ducts from the gall tract or intestine may activate the ferments of the pancreas sufficiently to bring about *autodigestion* (digestion of its own tissue).

This form of pancreatitis is likely to occur in persons addicted to alcohol and spicy foods. It may also occur as a complication of infection elsewhere in the body, in such diseases as syphilis and arteriosclerosis and in affections originating in the stomach, bowels, liver, and gall tract.

Chronic pancreatitis is a condition which usually manifests itself more insidiously than the acute forms of the disease. It may follow in the wake of an acute inflammation of the pancreas, but in most instances it will come on slowly, following the previous existence of disease in the intestines or gall tract. As in the acute forms of pan-



Shaded area shows the location of the pancreas between the stomach and the small intestine.

creatitis, infections of the pancreatic duct or interference with the outflow of the pancreatic secretion may invite an inflammation of the gland. Two chief symptoms of chronic inflammation exist: The first is chronic *interlobular* pancreatitis, which is characterized by an overgrowth of the connective tissue surrounding each lobule (small subdivision of a lobe), plus an atrophy (wasting of tissue) of the lobule substance itself. This condition is analogous to Hanot's cirrhosis of the liver, discussed in a previous chapter. The second is chronic *inter-acinar* pancreatitis which is characterized by an overgrowth of the connective tissue surrounding the small cells which make up the lobule. This form is analogous to Laennec's cirrhosis of the liver.

The symptoms of acute hemorrhagic pancreatitis are often preceded by symptoms which can be attributed to such previously existing ailments as gall-bladder disease, liver disorders, and duodenal disturbances. When this condition asserts itself, however, it is usually sudden, with fever, severe pain in the mid-abdomen, nausea or vomiting, a feeling of weakness, and indications of impending general collapse. The pain is often so excruciating as not to respond readily to hypodermic medication. This is probably due to the effects of pressure upon the neighboring nerve plexuses (networks or junctions of nerves). The great shock or threat of impending collapse may follow as a result of this severe pain, or from the effects of the absorption of poisons or toxic products created through the digestion of tissue by the pancreatic ferments. Vomiting, hiccough, and constipation may become pronounced in severe cases. Such complications as jaundice and diabetes frequently arise. The disease may end fatally in a few hours or days, but the acute process on rare occasions may clear up sufficiently to eventuate in a chronic pancreatitis. This condition frequently affects individuals who are obese and addicted to alcoholism.

The symptoms of severe acute pancreatitis closely parallel those of the hemorrhagic condition described above. There are mild forms of the disease, however, which frequently complicate gall-bladder and gall-tract ailments. Fortunately the disturbances in the pancreas are usually of a temporary nature, and with proper care these patients attain an excellent recovery. In these mild cases the symptoms are not intolerable.

The symptoms of chronic pancreatitis usually develop slowly over a period of months or years as a complication of liver or bile-tract disease. The original liver or gall-tract disease primarily gives rise to symptoms characteristic of that condition, but the pancreatic involvement will slowly produce symptoms of mild indigestion, such as bloating, belching, nausea, loss of appetite, and moderate distress in the epigastrium. As the condition progresses, such symptoms as vomiting or diarrhea usually appear. The pain is often quite severe and may be referred to the sides of the abdomen or the back. Occasionally jaundice develops because of pressure upon the bile passages, or because of extension of the inflammation to the common bile duct. General weakness, loss of weight, loss of flesh (cachexia), and anemia follow in the course of time.

Because of the ravaging effects upon the islets of Langerhan's portion of the pancreas (areas concerned with carbohydrate metabolism), temporary or permanent diabetes may develop, and the urine upon

examination frequently reveals the presence of sugar. The stool, when studied, will evidence the presence of undigested food elements such as muscle fibers, fats, and starches. The stomach test, when performed, usually elicits a diminution or absence of acid and ferments. The contents of the duodenum, when studied, will show a reduced ferment activity, due particularly to the damaging effect of the disease upon the secreting cells of the pancreas. The physician will frequently feel a hard, enlarged, irregular organ, somewhat tender to the touch, in the region of the epigastrium, and occasionally the liver and spleen are also found to be enlarged. An X-ray examination may, at times, give some information as to the nature of the process and its relation to the stomach, gall bladder, and other neighboring organs.

The treatment of the acute forms of pancreatitis should be directed toward removing the cause. Rest in bed and symptomatic medication which aims at relieving distressing complaints should be advocated. In mild forms of pancreatitis this type of treatment will occasionally prove satisfactory, but in severe cases, especially the hemorrhagic forms of the disease, surgery has frequently been resorted to in the past. In addition, supportive measures such as blood transfusion, intravenous feeding, and medication to combat pain are often indicated. It is likely that such new drugs as are represented by the sulfa preparations and penicillin may prove a boon in the future management of this disease. In the chronic disorder, attention to any complicating disease which may exist, such as liver, gall-bladder, or gall-duct affections, will demand consideration. A proper diet and non-irritating foods or drinks are to be adhered to for a long period of time. Bile drainage is often a beneficial procedure, and medicaments which aim at the prevention of bile-tract stagnation and at the stimulation of bile flow will prove valuable. Other measures to improve the general welfare of the patient are essential and include injections of iron, arsenic, vitamins, hormones, and other preparations, always under the guidance of an intelligent physician.

Hemochromatosis of the Pancreas—This condition is usually spoken of as *bronze diabetes*, and is allied with a general hemochromatosis (deposit of pigment throughout most of the organs and tissues of the body). This pigment is derived from the coloring matter of the blood, particularly the pigment known as hemosiderin. The pancreas is deeply discolored by the depositing of this pigment within it, and the organ as a whole is hard and somewhat shrunken. The liver and spleen also are usually affected in the same manner, as a result of which the flow of blood through the vessels of the portal system

(chief blood vessels of the abdomen) is somewhat impeded, resulting in the production of ascites (abdominal dropsy). The cause is not definitely known, but it is believed to be due to the effects of toxic irritation upon the liver and pancreas. This toxic effect may originate within the body, because of a disturbed metabolism or an improper elimination of poisonous substances. Again, it may result from the ingestion of alcohol or other poisonous substances.

The symptoms closely simulate those of chronic pancreatitis described above, but in addition the bronze pigmentation of the body in varying degree assumes a prominent manifestation. The intensity of the symptoms will vary with the degree of involvement of the pancreas, liver, and spleen.

The treatment is usually symptomatic and relies on the same broad principles adhered to in the consideration of chronic pancreatitis described above.

Cancer of the Pancreas—This condition, *carcinoma*, may occur as a primary or secondary process involving any portion of the pancreas. Most frequently the head of the pancreas is the site of the disease. When it asserts itself as a *primary* process in the pancreas, it usually spreads to other near-by organs such as the liver, the lymph glands, and the peritoneum. When it occurs as a *secondary* manifestation, it has usually developed through extension from a neighboring organ such as the stomach, the bile tract, or the intestines. Carcinoma is not the only malignant condition which may affect the pancreas. Occasionally *sarcoma* and *endothelioma* will assert themselves. The ailment ordinarily affects people in their middle or advanced years.

The disease will usually begin with a pronounced loss of appetite and a gradual loss of strength, loss of weight, and loss of body flesh. Frequently patients complain of pain in varying degree, confined to the epigastrium or penetrating through to the back. When the growth produces sufficient pressure upon the bile duct, jaundice will follow, and when the portal circulation (chief abdominal blood-vessel system) is encroached upon, ascites (abdominal dropsy) often occurs. The stool, when examined, will reveal quantities of undigested food such as meat fibers, fat, and starches. When the contents of the duodenum are obtained through a duodenal tube and analyzed, a definite diminution or absence of the ferments normally found in the pancreatic juice will probably be revealed. Upon examination, the physician will frequently be able to palpate or feel in the upper mid-abdomen a large tumor mass which is usually hard to the touch. An X-ray study may indicate the existence of a tumor, through the portrayal of pressure

effects exerted by the growth upon neighboring organs such as the stomach and the duodenum.

The treatment is chiefly palliative, aimed at relieving symptoms. The diet should consist of easily digestible food, with meats and fats in decidedly reduced quantities. Artificially prepared foods of a readily assimilable character will prove beneficial. Preparations containing pancreatic substance will aid the digestion of the foods eaten, and bile products should promote better bile flow. Surgery is often utilized to extirpate the growth or to relieve such complications as bile-duct obstruction.

Pancreatic Achylia—This condition corresponds to the stomach ailment, gastric achylia characterized by a *reduction in secretion*. In this disease, the secretion of pancreatic juice is reduced and frequently goes hand in hand with a reduced stomach secretion. The underlying cause is either a *nervous* disturbance, which results in a depression of the secretion of pancreatic juice, or an *organic* process which, through its destructive effect upon the secreting portion of the pancreas, brings about a diminution or complete depression of the pancreatic secretion. Some authorities feel that the condition arises as a result of a mild infection of the pancreas, because of which destructive changes occur in the pancreatic substance.

The symptoms of mild indigestion may be due to the stomach achylia which usually accompanies the pancreatic achylia. Diarrhea, a prominent symptom complaint in these cases, is chiefly the result of a defective digestion occasioned by the absence of a virile gastric juice and the existence of a devitalized or absent pancreatic secretion. Verification of the existence of weakened or deficient gastric and pancreatic secretions may be made through special studies directed toward the appraisal of the ferment values of the stomach secretion and the duodenal contents. Occasionally the stool is investigated for its ferment value, but the excrement when examined microscopically may also furnish evidence of undigested food elements which will point directly to pancreatic disorder as the cause.

The treatment very closely simulates that already described under achylia gastrica. Pancreatic preparations are given to aid digestion, by replacing the natural secretion which is lacking in this disease. Simple, puréed or mashed, easily digestible foods should be eaten. General tonic and supportive measures are used when warranted.

Pancreatic Cysts—This condition usually occurs as a secondary process within the pancreatic gland substance or within the pancreatic duct. It is the result of a damming up of the pancreatic secretion,

probably due to a blocking of the outflow of the secretion by a stone, tumor, or inflammatory process. Occasionally cysts develop within the pancreas, some of them by virtue of an overgrowth of tissue which embraces the secretion to form a *sac*, and some as *sacculated hemorrhages* following injury.

The symptoms will depend upon the size of the cyst and upon its pressure on surrounding organs, vessels, or nerves. At times pain is rather pronounced because of the tension within the pancreas itself, caused by the stretching effect of the enlarged cyst upon the structure of the gland. In other instances the enlarged cyst encroaches upon the duodenum or stomach outlet to an extent sufficient to hinder the proper elimination of food from these organs. As a result, signs of indigestion develop and, when the food is retained within the stomach and duodenum to a considerable degree, vomiting often occurs to rid these organs of their contents. Occasionally pressure upon the large liver vessels or gall ducts will cause congestion within these structures, and as a consequence fluid accumulation in the abdomen as well as jaundice may result. In rare cases the cyst may, through mechanical pressure, cause obstruction within the bowel tract or symptoms due to pressure upon other abdominal organs or structures.

The abdominal examination will usually elicit a large mass in the epigastrium or left upper half of the abdomen, which is tender but quite smooth to the touch. An X-ray study will often portray the existence of a cyst, by virtue of its pressure and the displacement of near-by organs such as the stomach, duodenum, and intestines.

The treatment is definitely surgical once the condition is recognized.

Pancreatic Calculus—Calculus or *stone* within the pancreatic duct manifests itself occasionally in older people, and is believed to be due to a *previous infection* of the duct of the pancreas which causes a sluggishness in the outflow of pancreatic juice into the intestine. The infection usually originates from disease within either the duodenum (upper small intestine) or the gall tract. The stones are white and occur in numbers, rarely singly. They vary in size from small granules to large marble-size concretions consisting chiefly of lime salts. When the stones blockade the pancreatic duct or its branches, the channel behind the obstruction becomes dilated and in some cases aids in the formation of a cyst as described above. At other times inflammation of the pancreatic substance occurs, because of this backward pressure of the pancreatic fluid.

The symptoms, as a rule, center around the manifestation of pain in the stomach pit (epigastrium). This pain may be spasmodic or con-

tinuous, and varies in severity. At times it is intense and can hardly be controlled, even by hypodermic injection with opiates. The pain often radiates to the left abdomen and left shoulder blade and is frequently mistaken for gall-stone colic. The shock from the pain occasionally results in general collapse. In rare cases, when the bile-duct flow is interfered with, jaundice may occur. The abdomen, upon examination, is quite tender to pressure, and the pancreas may sometimes be felt when it is swollen. The stool, upon study, often reveals a large quantity of undigested fat and meat fibers, and the urine may show the presence of sugar. The acute symptoms will frequently subside and the stones are often passed and may be found in the stool. The condition may clear up entirely or continue in a mild, symptom-free form for months or years.

The treatment is usually symptomatic, aiming at the relief of troublesome symptoms. Medical measures are frequently employed which purport to dissolve the stones or dislodge them from the pancreas. Bile drainage has been tried from time to time with variable degrees of success, and more recently the sulfa drugs are advocated to quell infection within the pancreas. A proper and limited diet, with a low calcium content, and pancreatic preparations to aid digestion are indicated. Occasionally, when medical measures fail to accomplish the desired result, surgery should be regarded with favor as a means of relieving the pancreatic block.

Inflammation of the Pancreatic Ducts—The pancreas has two main ducts and subdivisions ranging throughout its substance. One main duct drains the *anterior* portion (fore part); the other drains the *posterior* portion (hind part) of the gland. The secretion of the pancreas occurs normally at a very low pressure, and this invites sluggishness in the flow of the pancreatic juice. This factor, together with liability to infection from neighboring organs, contributes to inflammation within the ducts. Occasionally defects in anatomical development of the ducts also invite stasis and infection.

In occasional instances, because of a damming up of the pancreatic secretion in the pancreas proper, some of the tissue substance undergoes *fatty necrosis* due to the digestive action of the fat ferment, lipase. It is believed that the fat ferment of the pancreatic secretion is incited to this action by the presence of bile in the pancreatic duct. At times, because of backward pressure of the pancreatic juice, an *abscess* of the pancreas may develop, but this may also follow in the course of any inflammation of the pancreas.

The symptoms will depend upon the primary condition which usu-

ally precedes the involvement of the pancreas, such as duodenal or gall-bladder diseases. As is well known, such ailments are characterized by various digestive symptoms. Pancreatic involvement, however, brings out evidence of disturbed intestinal digestion, for it is the pancreatic juice which predominantly acts upon the foods in the small bowel during the process of digestion. As a result, evidence of disturbed pancreatic digestion is found upon examining the stool. Studies of the duodenal contents also will most likely show a diminution in the various ferments comprising the pancreatic juice. In the simple cases the symptoms will be chiefly those of a mild indigestion, but in the severe forms with complications the symptoms become aggravated and in addition pain, vomiting, diarrhea, or jaundice may appear. When *fatty necrosis* occurs, the symptoms are aggravated to a considerable degree and simulate those already described under acute hemorrhagic pancreatitis. In *abscess* of the pancreas also the symptoms will become aggravated, and the course of the ailment will vary depending upon whether the abscess is acute or chronic. When the abscess is enlarged, it is easily felt during the course of an abdominal examination.

The treatment is directed mainly toward improving the outflow of pancreatic juice, thus lessening stasis or sluggishness within the pancreatic ducts, or toward reducing the quantity of secretion elaborated by the pancreas. Medical preparations such as atropine or belladonna are given to produce the latter result. These drugs will also reduce spastic manifestations which at times affect the pancreatic and bile ducts, retarding secretory outflow. The use of Epsom salts or other cathartic waters may also reduce the degree of pancreatic secretion. Bile drainage is occasionally employed for the same purpose and to reduce retardation of pancreatic and bile outflow. Simple, bland, liquid or semi-solid foods are utilized and should consist chiefly of carbohydrates, small amounts of protein, and virtually no fats. When medical measures fail, surgery should be considered; especially does this hold good for complications as fatty necrosis, abscess, and pancreatitis.

CHAPTER XIV

Diseases of the Peritoneum and Diaphragm

Peritonitis—Peritonitis or *inflammation of the peritoneum* (the membrane lining of the abdominal cavity) is a not uncommon manifestation. It is the complication so frequently feared in cases of acute appendicitis. It may also occur, however, as a complication of disease involving almost any organ within or immediately adjacent to the abdominal cavity. In rare instances it develops through the blood channels as an extension from more remotely affected areas, as in acute arthritis, inflammation of the heart, and general infections.

The organisms most prominently identified with peritonitis are the streptococcus, staphylococcus, pneumococcus, and gonococcus germs, and *Bacillus coli*. In infections of the peritoneum which arise from the digestive tract, as in instances of perforation of gastric or duodenal ulcer or a ruptured appendix, the most common germs present are either the streptococci or the colon bacilli. In infections arising from the genital organs such as the uterus (womb) and Fallopian tubes (organs within the abdomen leading to the uterus), the organisms are usually streptococci, staphylococci, or gonococci. An infection of the peritoneum by the pneumococcus germ will originate from diseases of the respiratory system, particularly pneumonia.

Peritonitis occurs either as a *local process* or as a *general involvement* of the peritoneal cavity. In the former condition the disease localizes itself in a small area of the peritoneum, usually immediately adjoining the primary lesion, as in cases of acute appendicitis or perforation of the stomach, bowels, or gall bladder. In the latter condition the entire or greater part of the peritoneum is affected. In this disease, the peritoneum lining the abdomen and that portion reflected about the various organs of the abdomen are congested, and usually covered with a thin or heavy layer of fibrinous (elastic thready protein) material. The loops of intestine in the early stages of the inflammation are loosely adherent to one another because of this fibrinous covering,

but in the later stages they are often closely connected to each other because of it. Often a large quantity of serous (watery) fluid accompanies the inflammation and distends the abdomen considerably. Occasionally the fluid, instead of being serous, assumes a purulent (pus) character.

The symptoms will vary in accordance with the origin of the disease, coming on suddenly as in cases of ruptured gastric ulcer or appendicitis, or gradually as in instances of slow intestinal perforation occurring in typhoid fever or intestinal tuberculosis. When the peritonitis is *localized* the objective symptoms will in great measure be limited, whereas in *general* peritonitis the objective symptoms will pertain to almost any part of the abdomen. The chief symptoms are usually abdominal pain, spasm (contraction), and rigidity or stiffness of the muscles of the abdomen, with nausea or vomiting and general signs of infection, such as rapid pulse, fever, sweating, flushes, languor, and headache.

Pain is an early predominating complaint; its *localization* in any particular part of the abdomen carries significance and may indicate the true nature of the underlying ailment, such as appendicitis when the pain occurs in the right lower abdomen, and ulcer of the stomach or duodenum when the pain occurs in the epigastrium (upper mid-abdomen). In other parts of the abdomen, the pain signifies the probable existence of other underlying affections which precede the development of the peritonitis. When the peritonitis becomes *general*, the pain may also become general throughout the abdomen and may not necessarily be confined to any particular part. It will vary in intensity, increasing usually with the acuity of the inflammation and decreasing with the subsidence of the process. At times it is stationary, or it may be aggravated by deep breathing or body movements.

Distention of the abdomen is a common occurrence in peritonitis in the later stages of the affection, because of the pocketing of gas in the adherent intestinal loops or because of a temporary paralysis of the intestinal musculature. When this occurs, pronounced constipation frequently manifests itself. There are occasions when distention occurs because of a rupture of the bowel, in consequence of which gas escapes into the abdominal cavity. This is a dangerous manifestation, and the recognition of the true nature of the distention is therefore of great import.

Tenderness in early peritonitis is usually limited to the area of the abdomen overlying the primary seat of the inflammation, but in the later stages of the disease it may spread to other portions of the

abdomen. It is believed to be due to friction created by the movement of one inflamed surface over another. The muscle defense reaction, which is elicited by pressure of the hand upon the abdomen, may manifest itself as a mild muscle contraction or as a pronounced muscle rigidity. This reaction is a protective expression aimed at restricting the movements of the inflamed peritoneum. Sometimes the muscles are so rigid as to give the abdomen a board-like quality.

Nausea and vomiting are usual findings in peritonitis and are either the result of toxic or reflex nerve irritations. Hiccough is also a frequent manifestation and is believed to be due to a reflex nerve irritation of the diaphragm or to the pressure of distended intestine upon this upper abdominal partition. Other prominent symptoms of peritonitis are fever of varying degree, a rapid pulse rate, a tendency toward reduced blood pressure, variable manifestations of shock, and mental irritation. A blood examination will usually reveal a high white blood cell count (leukocytosis) and a certain degree of anemia.

Localized peritonitis which is confined to a circumscribed area of the abdomen has a better chance of resolving than a *general* peritonitis which involves the entire abdomen. In many instances of recovery from the acute process, patients will later present evidence of adhesions which, through contraction, may produce kinking or strictures of the intestines or of any tubular organ within the abdomen, thus giving rise to considerable distress to the patient.

The treatment is usually surgical and should be performed as early as possible. Drainage of a localized abscess at a comparatively early stage may advance recovery. Such anti-infectious agents as the sulfa drugs and penicillin should prove very beneficial in the treatment of peritonitis, and other medical measures aimed at supporting the patient and alleviating the symptoms are also indicated.

Tuberculous Peritonitis—This disease manifests itself ordinarily as either an *acute* or a *chronic* process.

The *acute* form, as in the condition of acute peritonitis just described, develops suddenly, with chills, fever, colic throughout the abdomen, and distention or bloating. The pain, tenderness, or rigidity may be localized or general throughout the abdomen, depending upon the origin of the disease and its extent. The condition simulates typhoid fever, in which the bowel involvement is pronounced, and peritonitis which occurs as a complication following rupture of the stomach or intestines. The recognition of the true nature of the condition will be facilitated by studies of the sputum, stool, and blood and by X-ray examination of the lungs.

The *chronic* form of tuberculous peritonitis is more prevalent than the acute form, and is not so severe in its manifestation as the latter. The symptoms are confined in great measure to the abdomen and digestive organs. Mild colic with diarrhea or constipation are usual accompaniments. As in ordinary peritonitis, the tenderness or abdominal rigidity may be either localized or general, and the intensity of manifestation of the symptoms will depend upon the degree of peritoneal involvement.

Three distinct types of the disease occur, which in a measure will modify the symptom expression. These are the *ascitic*, the *adhesive*, and the *ulcerative*. The *ascitic* form, as its name implies, refers to the presence in the abdomen of fluid or effusion, which accumulates over a period of weeks or months and causes the abdomen to become enlarged and the symptoms of pressure to assert themselves. The fluid is either distributed throughout the abdomen or sacculated and confined to certain parts. The *adhesive* form indicates the existence of adhesions between the peritoneum and other visceral organs. The abdomen is usually distended because of the accumulation of gas within loops of intestine, and the examiner's hand will often make out masses of slightly movable or fixed loops of gut. The *ulcerative* form occurs because of perforation of an ulcerative area, usually within the intestinal tract, as a result of which the peritoneum adjoining the perforative lesion becomes involved. Distention, diarrhea, constipation, colic, and fever are usually pronounced. The ulcerative process may continue to spread and form an abscess, which may rupture into the bowel or into the abdominal cavity or break through the surface of the abdomen at the umbilicus (navel), thus managing to evacuate its contents. Occasionally the tuberculous mass will contract and so constrict the bowel as to give rise to symptoms of obstruction.

The treatment, as in tuberculosis generally, embodies proper hygiene, nutritious food, and physical and mental rest. In addition, particular regard as to the diet should be observed when symptoms of indigestion and diarrhea predominate. Non-irritating, easily absorbable foods are essential to the welfare of these patients. Symptoms of discomfort should be controlled by proper medication. Alpine, quartz light, and X-ray treatments occasionally prove beneficial. Surgery is of great value in most instances because of the relief it brings in stimulating healing and the correction of untoward complications.

Chronic Peritonitis—The condition referred to as chronic peritonitis occurs in two forms, one characterized by the presence of

fluid and the other by *adhesions*. The disease is either localized or diffused (general) throughout the abdomen. The cause of its production is often unknown, but it is believed in many instances to be due to a *previous inflammation* of the peritoneum, as in tuberculosis, appendicitis, and ovarian inflammation. It is also an occasional *accompaniment* or *sequel* of such ailments as heart disease, rheumatism, syphilis, and injury.

The symptoms, as in other types of peritonitis, are related to digestive and intestinal disturbances and are either mild or aggravated. When adhesions are pronounced, pain may be rather severe. Often symptoms of pain are referred to the chest and back. The abdomen, upon examination, as in the other forms of peritonitis above described, reveals a degree of distention in accordance with the quantity of fluid and gas accumulations. At times loops of gut are felt and abdominal tension of varying degree is noted.

The treatment will closely simulate that already suggested for other forms of peritonitis, but known underlying causes should be given proper consideration and, as usual, prominent symptoms must be given particular attention. The sulfa drugs and penicillin should also prove of benefit in some cases.

Cancer of the Peritoneum—This condition may originate as a *primary* process in the peritoneum itself or as a *secondary* manifestation arising from a disease which originally occurred in some other organ, such as the stomach, bowels, gall tract, or kidneys. The former will occur as an extensive hard white thickening of the entire peritoneum associated with the production of effusion or fluid within the abdomen; the latter, which is the more common variety, will usually occur as nodules or masses of varying size studded throughout the peritoneum and the near-by omentum and mesentery (tissues attached to the visceral organs and containing their blood and nerve supply). In this secondary form an effusion or fluid accumulation as well as inflammation may also present itself.

The symptoms come on slowly and insidiously, and the disease is frequently not recognized until it is well advanced. The symptoms are similar to those already described above under tuberculosis and chronic peritonitis. The outlook is not good, but some patients live longer than others, depending upon the origin of the condition and the various other organs involved. Symptoms are chiefly referable to the abdomen and the digestive organs. Abdominal distention, loss of flesh, and weakness are outstanding symptoms. In perplexing cases

the correct diagnosis may be made by draining off some fluid from the abdominal cavity to see whether it will reveal cancerous tissue cells indicating the existence of malignancy.

The treatment is chiefly symptomatic and aims at palliation. Relief from abdominal fluid tension is often accomplished by the use of mercurial diuretics through injection, and attempts at cure of the disease are resorted to through deep X-ray therapy and other measures.

Other Tumors of the Peritoneum—Other tumors of the peritoneum include both *benign* and *malignant* growths. The former include lipomata (fat tumors) and certain cysts; the latter are endotheliomata (lining-cell tumors) and sarcomata (connective-tissue-cell tumors). These growths, as a rule, arise primarily from the layers of the peritoneum itself.

The symptoms will depend upon the nature of the growth and its exact location. Benign growths do not materially affect the patient's general condition, whereas the malignant tumors have a devastating effect upon the general welfare and cause symptoms to develop which characterize most malignant processes. Tumors, if large enough, will be felt upon abdominal examination, and fluid, if present, may be elicited by the examining hand. The abdomen, when filled with fluid, will usually appear enlarged and rotund. Pressure symptoms upon the visceral organs often arise. Various digestive symptoms and pain will frequently occur, and in rare instances signs of intestinal obstruction develop because of pressure effects.

The treatment for benign growths is surgical, aiming at extirpation. Malignant lesions, because of their hopelessness, require palliation in the form of medication, X-ray or radium therapy, and such supportive treatment as appears indicated.

Ascites (Abdominal Dropsy)—By this affection is understood an accumulation of fluid within the abdomen due to actual leakage of serum from the peritoneal blood vessels (particularly the veins) into the abdomen through backward pressure. This condition usually occurs as a complication of heart disease, affections of the kidneys, liver enlargements or shrinkage, and other ailments in which the chief vascular system of the abdomen is affected.

The symptoms associated with ascites will depend upon the underlying cause of the condition and the amount of fluid present. When the fluid is pronounced, the tension within the abdomen will be great, and symptoms of pressure upon the diaphragm, the abdominal wall, and the genito-urinary organs may become prominent. The abdomen itself becomes tense, distended, and glazed in appearance. Small

superficially enlarged veins are often seen over the upper abdomen. The examiner will readily elicit the existence of this increased fluid by palpating and percussing (tapping) the abdomen. In abdominal enlargements associated with peritonitis, pain is usually a prominent symptom, but in ordinary ascites this is not the case.

A thorough history and general examination will aid in the recognition of the ascites and in determining the reason for its occurrence. It will not be mistaken for peritonitis by the intelligent examiner. A rectal or vaginal examination should be made in cases of obscure origin. When necessary, fluid should be aspirated from the abdomen and examined for additional information.

The proper treatment of this condition will require the recognition of its underlying cause, such as heart or kidney disease. A proper diet with limited fluids and restricted salt intake may be necessitated. Hydragogue cathartics (water-releasing cathartics) often prove beneficial, as do diuretics (medicines to release fluids from the body). Mercurial diuretics administered by injection should aid considerably in alleviating the condition. Such supportive medication as appears warranted should be given to sustain the patient.

Diseases of the Omentum and Mesentery—The omentum and mesentery are organs within the abdominal cavity which in a physiological sense are related to the *peritoneum*, and for that reason affections involving these organs will be considered in this chapter. These organs are often the seat of inflammation and tumor formation. They could possibly be *primary* lesions but more likely are *secondary* manifestations originating in near-by organs, such as the stomach, intestines, gall tract, and appendix, and in general diseases such as syphilis, tuberculosis, and cancer.

Inflammations of the omentum and mesentery are accompanied by symptoms similar to those already described under peritonitis. In mesenteric disease with involvement of the blood vessels of this organ, the blood supply may be sufficiently disturbed to lead to gangrene and serious intestinal dysfunction. When adhesions develop, kinking of the intestines may sometimes occur.

In tumors involving the omentum and mesentery, symptoms corresponding to the nature of the diseased process and the location of the lesions usually arise, and these simulate in great measure those already described under peritoneal involvement.

The treatment will depend upon the nature of the disease, the symptoms that predominate, and the complications which involve the important organs. The general condition is, of course, a matter

to be attended to. Surgery may also, as in peritonitis or tumors of the peritoneum, be indicated in omental and mesenteric diseases.

DISEASES OF THE DIAPHRAGM

Because the diaphragm, which is the muscular partition separating the chest from the abdomen, is in close reflex connection with the abdomen, affections of this structure should also be considered under the heading of digestive disorders. As a matter of fact, many symptoms referable to the stomach and bowels occur in diseases of the diaphragm. Symptoms of pain and its reflection to various areas will depend upon the extent to which either the upper surface which covers the diaphragm from the chest side (pleural surface) or the lower surface which covers the diaphragm from the abdominal side (peritoneal surface) is involved. This is due to the fact that the surface areas of the diaphragm, as well as the muscular tissue of the structure itself, receive their nerve supply from different sources. Irritation of the upper pleural surface produces pain or sensitiveness in the front of the chest, and less often in the back of the chest, whereas an irritability of the lower peritoneal surface will create pains within the abdomen. On the other hand, a disorder within the middle layer or muscular tissue of the diaphragm will refer pain or sensitiveness to the neck, shoulders, and sides of the chest.

From the foregoing it may readily be seen how closely diseases of the diaphragm proper simulate, in their symptom expression, diseases affecting the organs of either the chest or the abdomen, and how careful the physician must be in making a correct interpretation. In addition to the manifestations of pain referred to above, such symptoms of indigestion as loss of appetite, nausea, fullness in the epigastrium (pit of the stomach), vomiting, diarrhea, constipation, and distention may occur.

Eventration or Relaxation of the Diaphragm—Eventration or relaxation of the diaphragm is believed to be a congenital condition and may be described as a loosening of a part of the diaphragm, as a result of which some of the abdominal organs such as the stomach or bowels crowd under this elevated relaxed partition, thus occupying space seldom afforded an abdominal organ. Symptoms frequently are not experienced for years but may suddenly or gradually come on in the form of a mild or severe indigestion.

Diaphragmatic Hernia—Diaphragmatic hernia is believed by some authorities to be congenital in origin; others are convinced that it is

acquired during life. It is presumed that the diaphragm has ruptured and that consequently some of the abdominal organs have entered the chest cavity. The left side of the diaphragm is the portion usually involved. It may occur as a result of injury, as in a severe fall, or after disease has affected the diaphragm.

The symptoms will depend upon the degree to which crowding manifests itself within the chest cavity, and this in a measure will depend upon how many organs enter this space. Symptoms referable to the chest, such as cough, shortness of breath, difficulty in swallowing, and disorders in heart action; and symptoms referable to the abdomen such as mild or severe indigestion and intestinal disturbances may possibly occur.

Thoracic Stomach—The condition spoken of as *thoracic stomach* is regarded as a developmental defect in which, since birth, the stomach has been situated within the chest above the diaphragm. Symptoms may or may not be present, depending upon the amount of pressure created within the chest and upon the degree of disturbance developed within the stomach and bowel tract.

All the above ailments should first receive dietary and medical attention to alleviate any existing symptoms, but, in the event of failure of these primary measures, surgery becomes the indicated treatment, at the hands of a trained and capable surgeon.

Other diseases of the diaphragm, such as *diaphragmatic abscess*, *diaphragmatic peritonitis*, and *diaphragmatic adhesions*, usually develop as a complication of diseases originating in either the chest or the abdomen. In addition to the ordinary signs of inflammation—fever, chills, rapid pulse, languor, and flushes—these conditions will present symptoms referable to either the chest or the abdomen, depending upon how predominantly these regions are involved.

The treatment will be either medical or surgical, or a combination of both.

CHAPTER XV

Digestive Symptoms the Result of Diseases in Other Organs

IN THE foregoing chapters, diseases of the digestive organs and allied structures have been the subject of consideration, and the parts they played in the production of digestive symptoms have been stressed. These symptoms were naturally expected to occur in disorders which definitely disturbed the physiological function of the digestive organs, but in organs not directly connected with the digestive system such symptoms were not always looked for. These manifestations, however, do occur in connection with expressions of disease involving non-digestive organs, and it is essential that their significance should be understood. Among the organs in which disorders may produce digestive symptoms are the heart and vascular system (blood vessels) including the blood itself, the lungs, the endocrine glands, the nervous system, the brain, and the kidneys. Certain general ailments characterized by fever and toxemia may also exercise a similar influence.

Diseases of the Heart and Blood Vessels—The *heart* and its large branches, the *aorta* and the *pulmonary vessels*, when they are the seat of organic disease or functional disorder, may give rise to prominent digestive manifestations such as loss of appetite, belching, fullness, pressure or pain in the epigastrium (pit of the stomach), constipation and diarrhea; vice versa, disorders within the stomach and bowels or gall tract may create disturbances in heart action—such as irregularity of the heart rhythm, rapidity or slowing of the heart beat, and various disorders of heart sensation from mild discomfort to attacks of angina. The realization of this mutual effect of one group of organs upon the other is exceedingly important to the physician and of great value in the treatment of disturbing complaints.

For the moment, however, we are especially interested in digestive complaints due to heart and circulatory diseases. These are a common occurrence and probably are brought about either through the medium

of the *blood circulation*, which often is sluggish (passively congested) in fairly advanced heart disease, or through the same *nervous apparatus* which, via intimate and intricate nerve connections, controls the activity of both the cardio-circulatory (heart and vascular) and the digestive systems.

In advanced heart and circulatory diseases the digestive symptoms are more likely to be pronounced than in milder cases. The damming up of the blood circulation in the liver, stomach, and bowels will affect the function of these organs to a certain extent, hence the development of digestive disturbances in pronounced heart diseases. The diseases of the heart which create this disorder, with its consequent digestive symptoms, are usually affections involving the *valves of the heart* and the *heart muscle*. They include diseases of the mitral valve (valve of the left side of the heart) known as *mitral stenosis* and *mitral insufficiency*; diseases of the tricuspid valve (valve of the right side of the heart) known as *tricuspid stenosis* and *tricuspid insufficiency*; and diseases of the aortic valve (valve of the large blood vessel leading to the heart) known as *aortic stenosis* and *aortic regurgitation*.

In the early stages of these heart affections, the passive congestion or damming up of the circulation may be rather negligible, hence the digestive symptoms are slight if any; but, as the heart efficiency breaks down or decompensates, the passive congestion increases and the digestive symptoms may become more prominent. In addition to the symptoms complained of, the organs of the abdomen such as the liver, spleen, and intestines become swollen, and the abdominal cavity may even fill with fluid, causing the condition referred to as ascites. *Myocarditis*, disease of the heart muscle, may also give rise to similar digestive disturbances.

Other heart conditions, especially *coronary thrombosis* (clotting within the coronary vessels), *coronary sclerosis* (changes affecting hardness of the coronary vessels), and other forms of heart disease included under so-called *angina pectoris*, give rise to symptoms usually characteristic of digestive ailments such as gall-bladder diseases or stomach and duodenal ulcer. These symptoms, however, are probably produced through the medium of the nervous system. They often manifest themselves reflexly as pain in the stomach, right upper abdomen, or lower abdomen, with reflections to the back and shoulders. In *sclerosis of the aorta* (the large vessel leading to the heart) similar symptoms may occur.

The treatment of these conditions should be directed toward im-

proving the circulation within the heart and digestive organs, and toward lessening the irritability of the digestive tract to prevent reflex influences on the heart.

Disorders within the Bronchial Tubes and the Lungs—Disorders within the bronchial tubes and the lungs may exercise pressure upon the vessels leading to or from the heart and thus disturb the circulation, causing a backflow or damming up of blood in the liver and other visceral organs, as described above under heart disorders. These disorders may also cause the production of digestive symptoms. Such diseases include the following ailments: *chronic bronchitis* (inflammation of the bronchi), *bronchial asthma* (spasm of the bronchi), *emphysema of the lungs* (air-distended lung spaces), *congestion of the lungs* (retarded circulation of blood flow from the lung vessels), and *tumors of the bronchi or lungs* which interfere with the blood circulation.

Tuberculosis of the Lungs—Tuberculosis of the lungs, either because of a *toxic* process or because of a *nervous* influence over the digestive organs, may give rise to digestive symptoms. The nerves controlling the functions of the various digestive organs may be affected by the toxemia which accompanies tuberculosis, and it is also possible that in other instances a diseased lung will reflexly produce disturbances in the nervous apparatus of the digestive organs, in consequence of which digestive disturbances follow. The symptoms of heartburn, belching, bloating, pain in the epigastrium, vomiting, diarrhea, and constipation may be the result of such conditions. The treatment should be directed toward the correction of the most probable causative factor. Symptoms believed to be due to spasm or irritability are often controlled by anti-spasmodic medication, nerve sedatives, and a non-irritating yet nutritious dietary regime.

Diseases of the Blood—Diseases often referred to as *anemia*, *leukemia*, and *chlorosis* are frequently associated with the development of symptoms of a digestive character. Such symptoms include loss of appetite, nausea, vomiting, bloating, diarrhea, constipation, and pain or distress in the epigastrium or other parts of the abdomen. In these blood diseases, the *stomach* and *bowels* at times exhibit a deficiency in secretion as well as in the assimilation of food products. Especially is this true in pernicious anemia, where studies of the stomach have usually revealed the existence of a defection in the secretion of acid and ferments. Some authorities believe that the *liver* and *pancreas* also function poorly in this disease. Absorption and assimilation of the proper food elements so vital to human welfare is, as a result, interfered with and such patients fail to thrive.

Treatment should therefore be directed not only toward the blood disorder itself, but also toward the improvement of the processes of digestion.

Diabetes—In diabetes, a disease especially concerned with the *metabolism of sugar*, it is not uncommon to find patients suffering from various digestive symptoms. Investigation has revealed that many diabetic persons have associated ailments, such as stomach catarrh, in which little or no acid is elaborated by the stomach. Often the stomach ferments also are reduced or missing. Gall-bladder disease, liver disease, and intestinal catarrh are often found allied with diabetes and these also give rise to disturbances in digestion. When such complications are recognized, they should be given proper attention.

Diseases of the Various Endocrine Glands—These organs, which occasionally give rise to disturbances in the digestive system, are the *thyroid*, *parathyroid*, and *pituitary glands*, the *adrenals*, and the *pancreas*. To some extent, other less prominent endocrine organs may possibly do so, but definite demonstration of this tendency is usually lacking.

The endocrine glands and the so-called autonomic nervous system are believed to supplement one another in their actions, and any disturbance in one group may produce a disturbance in the other. The nature of the disturbance, however, will depend upon which gland is affected and upon which portion of the nervous system is predominantly involved.

The *autonomic nervous system*, often referred to as the vegetative nervous system, consists of two main subdivisions, known as the *vagus* and *sympathetic*. These two nerve divisions are intimately concerned with the regulation of the function of the digestive tract; hence a disorder in these nerves or in the glands which influence them may cause digestive symptoms. Depending upon the prominence of the symptoms in one gland or another, which is known to correspond to the predominance of irritation in either branch of the nervous system, the symptoms are designated as either *vagotonic*, concerned chiefly with an increased action of the *pancreas* and *parathyroids*, or *sympathicotonic*, related to an increased activity of the *thyroid* and *adrenal* glands.

In *hyperthyroidism* or *exophthalmic goiter* (Graves' or Basedow's disease), in which the thyroid gland is regarded as overactive, it is quite common to find the stomach and bowel functions disturbed; as a result, such symptoms as anorexia (loss of appetite), nausea, vom-

iting, heartburn, epigastric fullness, intestinal bloating, constipation, and diarrhea may occur.

In *hypothyroidism* (reduced thyroid activity), on the other hand, digestive manifestations are less apt to develop, but constipation is a frequent accompaniment of this condition.

In *hypo-adrenia*, a condition characterized by underfunctioning of the adrenal gland, symptoms of indigestion frequently are prominent. Research studies upon animals even suggest that peptic ulcer may originate in a disorder of the adrenal glands. Injections of adrenalin and other adrenal substances have improved digestion and corrected symptoms.

In *pituitary gland disorders*, particularly those affecting the posterior portion (hind part) of this organ, symptoms of indigestion are quite common. In *diabetes insipidus*, in which large quantities of urine are passed, the disorder is believed to have its origin in the posterior lobe of the pituitary. In this condition digestive disturbances of varying intensity frequently occur. Although in a measure the disease is due to the drinking of large amounts of water (because of excessive thirst), it is probably also the result of nerve-system irritation which may be attributed to a disturbance in the pituitary gland. Pituitrin, an extract of the posterior lobe of the pituitary gland, has often relieved abdominal pain by reducing intestinal distention or by increasing both intestinal tone and peristalsis.

Treatment is directed toward the improvement of the functions of the various endocrine glands, particularly those predominantly involved. The different digestive symptoms are corrected by such measures and medicaments as seem indicated.

Disorders of the Genital Glands—As in endocrine gland disturbances, so also in disorders within the ovaries and uterus, symptoms of indigestion which may arise are probably the result of *reflex irritation* of the autonomic nerve system. This manifestation is often noted during menstruation, child-bearing, and the menopause. At these periods there is a probable imbalance in the elaboration of *hormones*, in consequence of which the autonomic nervous system becomes disturbed.

Such symptoms as nausea during pregnancy and abdominal cramps during menstruation are well known to women generally. Symptoms of indigestion referable to the stomach and bowels are common occurrences in the menopause and in various diseases affecting the uterus and ovaries, such as uterine displacements, infantile uterus, ovarian cyst, ovarian inflammations, and functional disorders of the ovary.

The treatment of the digestive disturbances in these disorders, of course, presupposes a knowledge of their connection with genital disruptions.

Diseases of the Spleen and Kidneys—Enlargements of the spleen due to splenomegaly, splenic cyst, Gaucher's disease, and splenic inflammations may at times cause symptoms referable to the digestive system. These symptoms are often due to pressure of the enlarged spleen upon the stomach, bowels, or gall tract. Occasionally, because of effects upon the blood vessels of the stomach in splenic diseases, bleeding occurs, as evidenced by the vomiting of blood. In some instances bleeding occurs within the intestines, as indicated by the presence of tar-colored or bloody-appearing stools. Jaundice occasionally manifests itself because of pressure upon the gall ducts. Sometimes pain, fullness, or dragging sensations are felt in the left upper abdomen, but this also occurs in other portions of the abdomen as a result of pressure effects created by enlargements of the spleen and liver. Following pressure upon the stomach, bowels, and gall tract, such symptoms as anorexia, nausea, belching, bloating, mild colic, diarrhea, and constipation may develop.

Kidney diseases of almost any type are capable of producing digestive symptoms. In such ailments as *nephritis* (inflammation of the kidneys), *nephrosis* (degenerative changes in the kidneys), *congestions of the kidneys*, and *arteriosclerosis* of the kidney vessels, symptoms of stomach and bowel irritability may occur because of toxic influences. In these kidney conditions, especially where toxic products are retained within the blood to a pronounced degree, the effect of such substances upon the liver, stomach, bowels, and general nervous system may be striking and digestive symptoms may occur.

Occasionally a low-placed kidney, referred to as *nephroptosis*, or a widely movable kidney may exercise mechanical effects upon the stomach, bowels, or gall tract and in consequence give rise to various digestive symptoms. These effects may result from reflex nerve irritation or from direct pulling or pressing influences upon various portions of the digestive system. In *calculus* (stone) within the kidney or ureter (duct leading to the bladder from the kidney), it is not uncommon to find the victims of this affection complaining of reflex disturbances within the stomach or bowels. Such symptoms as pain in the epigastrium, nausea, vomiting, distention, diarrhea, and constipation are frequent in most kidney ailments. In rare cases, where the pulling or pressure effects are pronounced, even jaundice, violent bile tract colic,

and intestinal obstruction may occur. The treatment is primarily directed toward correcting the cause.

Diseases of the Brain and Spinal Cord—In affections of either the brain or the spinal cord it is not infrequent for manifestations of indigestion to occur. This is probably due to the fact that the brain and spinal cord are in close relationship with the nerves presiding over or controlling the digestive organs. The *vagus nerve*, which is closely connected with the functions of the digestive tract, arises in the brain and therefore is liable to irritation in brain disorders. Similarly, the spinal nerves which originate from the spinal cord mediate with the *sympathetic nerve*; the latter is closely identified with the function of the digestive organs, hence the liability of sympathetic nerve irritation in affections of the spinal cord.

In *encephalitis* (inflammation of the brain) and *brain tumor*, various symptoms referable to the digestive system may arise; these are difficulty in swallowing, nausea, vomiting, abdominal pain, belching, and constipation. Projectile vomiting (forceful ejection of the contents from the stomach) is regarded as a characteristic finding in brain tumor. In certain brain conditions, disturbances in the movements of the tongue and mouth and in swallowing are predominant. In lower spinal disorders, sensory disturbances may occur within the abdominal wall.

The treatment, naturally, should first be in the direction of the brain and spinal cord, and attention to the digestive symptoms should be regarded as a secondary matter.

Disease of the Eye—Affections involving the eyes are common, as attested by the fact that great numbers of people wear glasses. Many individuals, however, cover a great span of their lives without glasses and unknowingly suffer from *eye strain*. When difficulty exists in adapting the eyes to a full view of the environment, reflex irritation of other nerves may occur and it is not uncommon to find that individuals suffering from eye strain complain of such digestive disturbances as nausea, vomiting, heartburn, and constipation. As a matter of fact, any eye condition which interferes with the proper attainment of vision can produce such reflex manifestations.

The treatment should aim at correcting vision either by the use of eyeglasses, by exercises to improve the function of the ocular muscles, or by operations to correct ocular muscle defects. In some instances medication may serve a useful purpose. The digestive symptoms should disappear upon improving the adequacy of vision.

Migraine—Migraine is a condition usually characterized by the simultaneous expression of pain in the head and a digestive upset. It

is often regarded as a *bilious* headache, and frequently occurs in attacks over a period of years. The exact cause is unknown, but it is believed in many instances to be due to auto-intoxication, allergy, improper digestion, or constipation. Such digestive symptoms as nausea, vomiting, anorexia, abdominal fullness, diarrhea, and constipation may occur.

The treatment must take into consideration the probable underlying cause, such as auto-intoxication, allergy, familial disposition, constitutional disease, diseases involving local organs near by—such as the nose, sinuses, eyes, ears, and throat—or so-called purely nervous afflictions.

Infectious Diseases—Infectious diseases of a general character which are associated with the prominent expression of digestive symptoms are *sprue*, *typhoid fever*, *typhus fever*, and *paratyphoid fever*.

SPRUE—Sprue is a tropical disease thought to be due to an infection by the parasite known as *Monilia psilosis*. The ailment is especially characterized by an *atrophy* (wasting or thinning) of the lining of the stomach and bowels. This process may involve the entire digestive system from the mouth down, including the liver and pancreas. Rawness and ulceration of the tongue and other parts of the mouth are common manifestations. Because of the diseased condition of the lining of the digestive organs, such symptoms as indigestion, pain in the epigastrium and other parts of the abdomen, and diarrhea often occur. Defection in the absorption and assimilation of foods by the diseased intestine results in noticeable malnutrition, and the stool will exhibit evidence of considerable amounts of undigested food.

The treatment is aimed at controlling the infection, improving the digestion with proper medicaments, and giving attention to such complications as malnutrition and anemia.

TYPHOID FEVER—Typhoid fever is an infectious disease caused by the typhoid bacillus. Fortunately it has definitely been controlled during the past quarter century by proper sanitation measures and the use of typhoid vaccine as a preventive.

When the disease occurs, it manifests itself to a great extent as an abdominal complaint, because of its characteristic intestinal lesions. Such symptoms as indigestion, pain in the abdomen, distention, diarrhea, and constipation occur. The stool, at times, may evidence bleeding.

TYPHUS FEVER—Typhus fever is an infection transmitted by the body louse. It usually lasts about two weeks. In addition to the symptoms which ordinarily accompany a general febrile disease, there are symptoms of mild indigestion and constipation. If the case is not fatal, convalescence is usually rapid.

PARATYPHOID FEVER—Paratyphoid fever is an acute febrile disease due to infection by the paratyphoid bacillus. In its course it resembles a mild case of typhoid fever or "summer complaint."

The symptoms, in great measure, involve the digestive tract, and may include anorexia, nausea, vomiting, diarrhea, and abdominal pain. At times jaundice also manifests itself.

The treatment of these various infectious ailments involves certain special considerations and such general measures as appear indicated.

Poisonings—Poisonings by metals such as *lead*, *mercury*, and *arsenic* sometimes occur. Lead poisoning is found occasionally in persons engaged in occupations which expose them to lead absorption, such as painters and plumbers. Arsenical and mercurial poisonings usually occur in persons who have undergone treatment for affections requiring the use of arsenic or mercury.

Symptoms referable to the mouth, stomach, and bowels may occur in any of these poisonings. They include swelling, discoloration, and bleeding of the gums, infection of the teeth and jaw bone, swelling of the salivary glands, hypersalivation, nausea, vomiting, distention, pain in the epigastrium, abdominal colic, diarrhea, and constipation.

Treatment is aimed at ridding the body of any accumulated poison, palliation of the suffering, and the correction of untoward symptoms.

CHAPTER XVI

Allergy and Deficiency Diseases

Food Allergy—The condition which expresses an exaggerated response or hypersensitiveness of the living human body to certain specific foods is referred to as food allergy. The active ingredient of the foods which brings about this increased sensitiveness in the tissue cells of the body is usually a protein substance, or some ferment or chemical element closely allied to it.

Food allergy may express itself in mild or severe forms and in a variety of ways. It may affect persons from infancy to old age and is no respecter of social status. It may manifest itself temporarily or for long periods, and may be either *acute* or *chronic* in its expression. It is often inherited, but frequently it is acquired through overindulgence in certain foods or the taking of unusual foods. In many instances the reactions to food are so mild as to be overlooked by many physicians.

Food allergy may also complicate a hypersensitiveness already existent because of such other factors as dust, pollen, and animal emanations. This fact must be borne in mind by the physician when treating allergic individuals. Food allergy may manifest itself in different body tissues, such as the skin, the respiratory tract, the digestive system, the genito-urinary organs, the brain, and the nervous system. On occasions, a person who has suffered for years from a food allergy characterized by a skin eruption will improve in this respect and develop a digestive disorder in its place.

For many years, attempts have been made, through skin tests, to demonstrate the existence of food sensitiveness (allergy). This is done by applying extracts of various food substances to scratches made on the skin and observing the local reactions which present themselves in the form of a wale (wheal) or hive-like eruption. The more prominent the eruption, the more sensitive the individual is considered to be toward the specific food. Unfortunately many food-sensitive individuals present no positive reactions to foods; hence the test is of little

value in these cases. This is especially true of the mildly sensitive cases, which are often difficult to treat. The allergy must then be controlled by discovering the foods to which the individual is allergic or sensitive and omitting them from the diet over a period of time, as a result of which the patient's symptoms are improved. Certain authorities, therefore, have resorted to so-called *elimination diets* to help establish the diagnosis of food sensitiveness and to aid in the eradication of the condition. This is usually done by excluding the suspectedly troublesome foods from the diet, and then, after the symptoms have entirely abated for a time, reintroducing them into the diet in small quantities so as not to bring about a reaction. Of course it is essential that other foods which have the much-needed caloric value, vitamin content, and other necessary elements should be substituted wherever possible, to replace those removed.

Allergy or food sensitiveness has for many years been recognized as a prominent factor in the production of asthma, hay fever, and urticaria (hives), but only in more recent years have digestive disturbances been regarded as occasionally under its influence. Digestive disturbances frequently believed to be of allergic origin are the following: sensory disorders of the tongue and mouth, canker sores within the mouth, swellings of the tongue, the lips, and the lining of the cheeks, nausea, loss of appetite, vomiting, intestinal pain or colic, distention, diarrhea, and constipation.

Because of the resemblance of the symptoms produced in allergies to symptoms which characterize certain definite diseases, it is not uncommon for a mistaken diagnosis to be made. Ailments with symptoms similar to those of allergy are affections of the gall bladder, ulcer of the stomach or duodenum, appendicitis, colitis, and rectal conditions.

On the basis of a definite history of allergy, it is not uncommon to find digestive symptoms which can be attributed to food sensitiveness. Such symptoms occur in persons already suffering from *asthma*, *hay fever*, or *urticaria* (hives), and study has often revealed that the victims of these conditions are sensitive to one or more foods. Some of the commonly offending foods are eggs, shad roe, caviar, milk, cheese, beef, pork, cabbage, rice, potatoes, paprika, lettuce, beans, and berries.

The digestive disturbances are believed to be due to the reaction caused by the contact of the food with the lining of the digestive tract, just as hay fever and asthma are believed due to a reaction which occurs when pollens come in contact with the tissues lining the respiratory tract. Of course it must be considered likely that food allergy,

like other forms of increased sensitiveness, may fundamentally depend upon an *inherited tendency* or upon *acquired sensitivity* characteristics, particularly those affecting the digestive organs.

Examination of the digestive tract of a number of cases of true food allergy have revealed the following: edema (waterlogging) of the lining of the bowel, urticarial (hive-like) swellings of the stomach and intestines, hemorrhages (bleeding) within the bowel wall, and spasm (contraction) of the intestinal musculature. This proves definitely that tissue sensitiveness often results from *organic* changes within its substance, and is not always a simple *functional* (non-structural) manifestation. The diagnosis of the condition will depend in great measure upon the history of the case. Digestive distress which comes on only after eating certain foods suggests food allergy; when it occurs in persons who evidence other allergic manifestations, such as asthma, hay fever, and urticaria (hives), it becomes doubly suspicious.

The treatment of food allergy will require either the elimination of the offending food from the diet, or the gradual immunization of the individual against this food sensitiveness by various measures. In addition, such medical measures as each case warrants should be utilized.

DEFICIENCY DISEASES

Deficiency diseases, the result of a lack of assimilation of various food elements by the body, occur as definite entities, but they also occur as so-called *subclinical conditions* (mild forms of malnutrition) which may be associated at times with the production of other diseases not regarded as deficiency ailments. As our knowledge of nutrition improves, it becomes more evident that many diseases heretofore regarded as diseases of the respiratory system, of the heart and circulation, of metabolism, of the digestive system, and of the nervous system may fundamentally result from nutritional disturbances or improper dietary adjustments.

Fortunately for the majority of people in this great country of ours, all types of food in plentiful quantity are available. This is to be credited in great degree to our national progress in the art of agriculture and animal husbandry, as well as to the remarkable advance made in the preparation and preservation of foodstuffs, as in the canning and dairy industries. Finally, the all-important function of getting the food to the individual is realized through the remarkably efficient systems of transportation with which our nation is equipped.

Despite these wonderful facilities for obtaining food, however,

many individuals continue to live on dietaries which supply inadequately the various food elements essential to the maintenance of proper nutrition. This is by no means the result of economic embarrassment, since many persons in comfortable financial circumstances become victims of a deficiency ailment.

Other factors contributing toward derangements in the dietary are many. Personal tastes and habits play an important role. Psychological and emotional influences are determining factors. Social customs and dietary fads are widely prevalent and may invite an imbalance in food arrangements. Even the dietary advice of physicians may occasionally work out to the disadvantage of the patient if carried too far. This is particularly true in cases of individuals suffering from obesity and digestive ailments. Persons afflicted with metabolic diseases such as goiter and diabetes, or with digestive disorders such as duodenal ulcer, gall-bladder disease, and colitis, may suffer from a deficiency condition due either to the lack of proper food or to its poor absorption and assimilation.

The average diet, according to students who have thoroughly investigated the subject, reveals that about half of its energy-producing foods are composed of *non-vitamin-bearing* foodstuffs, such as refined sugars, highly milled or polished grain foods, and fats. The remainder of the diet, therefore, is made up of foods which furnish *essential proteins* necessary for the growth and repair of tissues as well as for the manufacture of such vital body products as the secretions, hormones and ferments, *vitamins* which supply factors necessary to the maintenance of health, and *minerals* needed for proper body nutrition. A definite deficiency in any of these food factors may lead to disturbances within the body.

A *deficiency of protein* may occur in the body of persons who eat an insufficient quantity of this food, or who do not adequately absorb the amount ingested. It may also occur because of an excessive loss of protein from the body, probably the result of starvation or disease. In some instances it may be due to a defection in the assimilation or retention of the digested protein after it is once absorbed.

As a result of such a deficiency, the protein level in the blood is reduced. This condition is referred to as *hypoproteinemia*. During war periods, in countries sharply affected by a lack of nutritional supplies, especially protein foods, edema (dropsical water accumulation) is found in large numbers of people because of a lowering of the osmotic pressure balance existing between the blood and body tissue fluids. Blood plasma and other predigested forms of protein are now given

intravenously to overcome these deficiencies and their harmful effects. Protein defection also can lead to *anemia* because of the lack of this constituent, which is needed to construct the hemoglobin molecule of the blood.

A *deficiency of carbohydrates* occurs in the body under certain conditions, as in starvation, following the ingestion of poorly arranged dietaries. This deficiency may be caused by certain diseases such as diabetes, by metabolic disturbances due to other factors such as thyroid or adrenal gland disorders, by liver and pancreatic disabilities (in which sugar is not stored up in the tissues), or by disturbances of digestion and absorption such as may occur in diseases of the stomach, intestines, and pancreas. A lack of carbohydrates in the diet may contribute to the production of body fatigue. When an insufficient quantity of carbohydrates is ingested, the body may be forced to call upon the protein reserves to furnish energy; as a result, essential food elements and tissue-building material are lost to the human economy.

A *deficiency of fat* in the diet may lead to many disturbances within the body. First of all, to indulge in physical activity, sufficient fat should be supplied in the dietary lest demands will be made upon the carbohydrate reserve, body fat, and protein tissues. The result of a continued lack of fat in the dietary will be loss of weight, wasting of tissues, and occasionally acidosis; the last of these may sometimes become a serious condition. In addition, fats ordinarily contain such *essential vitamins* as A and D; when these are lacking, symptoms resulting from their absence will appear.

Body growth in children diminishes and is at a rate far below normal when a diet low in fat is continued. In a condition referred to as *celiac disease*, which often occurs in young children, there is difficulty in fat absorption which, together with an associated deficiency in the absorption of mineral and vitamin elements, results in the creation of such conditions as *anemia*, *osteoporosis* (increased porosity of bone), and *tetany* (intermittent muscular contractions of increased tone). Young children need considerable fat in their diet, because its presence in sufficient quantity favors the absorption of calcium (lime), so necessary to the development of the teeth and bony structure of the body. It is therefore evident how seriously a child may be handicapped by a fat-poor diet.

A *mineral deficiency* in the body often results from an inadequate supply of certain foods which contain these substances. Milk, probably the best source of calcium, is usually avoided by adults, and for that reason many individuals who in addition dislike other dairy foods

may have a reduced calcium content in their bodies. The outer coverings of fruits and vegetables contain much mineral material, but these parts are seldom eaten. Many persons avoid soups which contain mineral matter and for that reason suffer from mineral deficiency. Minerals are necessary for the building up of many *body tissues*. They also aid in the maintenance of a proper *acid-base balance* (chemical condition of the blood) and of the so-called *osmotic pressure* between the blood and the tissue fluids. This is of vital importance to the body welfare.

Calcium, iron, phosphorus, and iodine are the chief mineral substances with which we are concerned, and their presence may occasionally be appraised if necessary. The two minerals most likely to be deficient are calcium and iron.

Iron is necessary in proper quantity to maintain a normal hemoglobin content. If this is not furnished, a form of *anemia* results. Since the body continually loses iron, a constant supply is needed for replenishment.

Calcium is necessary in the body to build and strengthen the *teeth* and the *bony framework*, to aid in the promotion of *blood clotting*, to regulate the *irritability of the muscular and nervous structures* of the body, to control the rate and force of the *heart beat*, and to contribute to the *acid-base balance* of the blood, the *osmotic pressure*, and other functions.

Other mineral elements such as *phosphorus, iodine, sodium, potassium, magnesium, and copper* are also of value to the human body; these are derived from various food substances.

VITAMINS

Vitamins, often spoken of as accessory food factors, are important not only in the prevention of *deficiency* states, but also in the maintenance of a *normal* nutrition. A reduced supply of vitamins, however, instead of producing an obvious deficiency disease, may invite the development of so-called *subclinical* (short of symptom-producing) forms of deficiency. This type of disorder is characterized by milder symptoms than those which occur in clear cases of deficiency disease. Vitamins are believed to have specific influences over the functions of tissue cells throughout the body and are therefore essential to health.

Vitamin A Deficiency—Vitamin A deficiency occurs in persons who for a protracted period of time have lived on foods containing an inadequate supply of this factor, or who have avoided foods con-

taining a liberal supply of this substance. Dairy foods, such as milk, cream, butter, cheese, and egg yolk, and other foods such as carrots, sweet potatoes, lettuce, beans, prunes, salmon, and fish livers contain abundant quantities of this material.

This vitamin is concerned principally with maintaining the *structures* of the body cell rather than with its metabolism (wear and tear activity). When this element is deficient, destructive changes occur affecting many of the tissue surfaces of the body, such as the linings of the nose, gullet, respiratory tract, and urinary tract. *Night blindness* is an outstanding manifestation of its absence in the body. Skin eruptions (dermatosis), hardening or thickening of the skin (keratinization), softening of previously hardened skin (keratomalacia), defection in hearing, retarded growth in children, loss of weight and strength, anemia, and lowered resistance to respiratory infections may all occur in persons suffering from a deficient intake of this vitamin. It is also needed for the formation of healthy *teeth* and *gums* as well as for *reproductive* purposes.

Conditions due to vitamin A deficiency should be corrected, if possible, by the ingestion of foods containing vitamin A and by the use of medication which contains *carotene* (provitamin A) and vitamin A in concentrated form. Preparations for this purpose are made from the livers of such fish as tuna, shark, cod, and halibut.

Vitamin B Complex Deficiency—Vitamin B complex deficiency occurs in persons who have had insufficient quantities of foods containing this factor, or who for some reason have failed to assimilate the quantity needed for the promotion of normal health. Many vital factors make up this vitamin B complex. They are vitamin B₁ or thiamine, vitamin B₂ or riboflavin, nicotinic acid, vitamin B₆ or pyridoxin, pantothenic acid, adecylic acid, and a filtrate factor. These vitamin B complex constituents are derived from whole grains, egg yolk, liver, meats, yeast, and leafy vegetables.

Vitamin B₁ or Thiamin—Vitamin B₁ or *thiamin* is present in such foods as lean pork, smoked ham, peanuts, beans, peas, cereals, bread, yeast, and various other vegetables and fruits.

This vitamin is not stored in the body to any appreciable extent, and must therefore be supplied constantly to aid the cells of the body in performing their normal functions. It appears to be rather intimately concerned with the *metabolism* (breaking up and assimilating) of *carbohydrates* and with *muscular activity* in general. It is essential to the general welfare and supports growth, appetite, digestive functions, and other important activities. When this food factor is lacking, such

manifestations as reduced strength, loss of weight, impaired growth, digestive disorders, and nervous irritability may occur. In pronounced defections, peripheral neuritis, spinal-cord disturbances, disorders of the brain, and the disease known as beriberi may occur. In persons addicted to alcoholism and in those suffering from debilitating conditions such as fevers, diabetes, thyroid intoxication, and pregnancy, vitamin B₁ is usually not supplied in sufficient quantity; hence disturbances often arise which are characteristic of its defection.

The treatment of vitamin B₁ deficiency demands the administration of foods which contain this element; in addition medication consisting of the concentrated substance may be given either by the mouth or by injection.

An ailment characteristic of manifest vitamin B₁ deficiency is *beriberi*, which is seen in the Far East and the Philippines. It appears in milder form in the United States. The ailment is characterized by degenerative changes of the heart, nervous structures, and muscle tissues.

In its milder forms, weakness, fatigue after exertion, palpitation, rapid heart rate, dyspnea (shortness of breath), slight edema (fluid in the lower limbs), and anesthesia (reduced sensation) over the skin surface of the legs are frequent complaints.

In advanced cases, sensations of anesthesia over the legs become more marked, the calves of the legs are painful to pressure, the muscles undergo wasting, walking becomes difficult, fluid may accumulate in the tissues, and the heart enlarges with the advent of symptoms referable to disease in this organ. Mild forms of indigestion with vomiting are common symptoms, and constipation or diarrhea also are frequent complications.

Vitamin B₁ in the form of food or medication is the proper treatment. In addition, other vitamins are often given to implement healing.

Vitamin B₂—This vitamin, also known as *riboflavin*, is necessary to the body, along with B₁, to promote normal metabolic action of the cells and proper nutrition. It is found in many foods, such as lean meats, liver, kidney, milk, beans, peas, prunes, fish, cheese, eggs, yeast, and other vegetables and fruits.

Vitamin C—Vitamin C is found in such plant products as peppers, spinach, and other green vegetables, and in cabbage, turnips, asparagus, oranges, lemons, tomatoes, celery, berries, apples, and other fruits. Cooking of these foods, however, in great measure destroys their vitamins.

A deficiency of this vitamin in the body is attended by various symptoms, such as fatigue, loss of appetite, soreness in the joints, softening of the bones, hemorrhages in the skin and linings of the respiratory or intestinal tract, spongy or bleeding gums, and dental decay. When the vitamin is reduced or absent for a long period of time, *scurvy* develops, as appears in the history of persons thus afflicted on long ocean journeys, who had been deprived of foods containing this factor.

The treatment of vitamin C deficiency is accomplished by supplying foods which contain this vitamin or by giving the vitamin in concentrated form in either tablets or liquids or by injection.

SCURVY—Scurvy is one of the original outstanding deficiency diseases and is now definitely recognized as due to a lack of vitamin C in the diet. Vitamin C, as already mentioned, is spoken of as the *anti-scorbutic* vitamin; it is found chiefly in fresh fruits and vegetables and, to a lesser extent, in meats. Denial of these foods to a pronounced degree, over an extended period of time, may bring on this disease.

The disease is characterized by hemorrhage (bleeding) in various tissues of the body, as in the gums of the mouth, the stomach, and the bowels, and under the skin. The gums are swollen, red, and spongy and bleed upon slight irritation; at times they ulcerate and slough away from the teeth. Disturbances of function involving the stomach and bowels often give rise to the various symptoms of indigestion and diarrhea. When bleeding occurs, the stool evidences blood or dark, tarry-colored stools. The general condition of the individual is characterized by weakness, loss of weight and strength, and reduced general resistance.

The treatment is directed toward removing the cause by adding proper food elements to the diet. In addition, such medication is given as appears warranted to correct disturbing symptoms.

Vitamin D—Vitamin D refers to a group of related substances called *sterols* (solid alcohol compounds), ten or more in number, which have *anti-rachitic* (rickets-preventing) qualities. These substances, which possess this attribute of protecting against the development of rickets, are found in natural form in fish-liver oils, milk, eggs, animal liver, cream, oysters, and clams. Vitamin D is produced artificially by exposing various foods such as cereals, meats, eggs, oils, and vegetables to ultraviolet irradiation (exposure to chemical rays beyond the violet end of the spectrum).

This vitamin is essential to *growth* and to *calcification* (adding of lime) in the bones and teeth, thus aiding in their development. It

helps to regulate *mineral metabolism* and, as already stated, helps to prevent *rickets*. Its absence or deficiency contributes to the poor calcification of bone, which frequently results in deformities, stunted growth, and rickets. Delay in the formation of *teeth* and defects in their calcification which invite decay also occur because of vitamin D deficiency.

The treatment of this deficiency naturally implies the administration of vitamin D or foods containing this substance, as well as other indicated medication.

Vitamin E—Vitamin E is sometimes referred to as the *anti-sterility* vitamin, but its use in human beings has not yet been proved of definite value; some authorities, however, are already disposed to employ it. This food factor is found in wheat-germ oil, milk, meat, eggs, butter, oysters, whole-grain cereals, lettuce, and oils from cottonseed, peanuts, and soy beans.

This vitamin is believed necessary for normal *reproduction* (production of a new generation of living beings) in animals and probably in the human race. Its deficiency or absence may give rise in animals to disturbances in reproduction, in the functions of the placenta (organ of communication between offspring and mother, called the after-birth because it follows delivery of the offspring), and to generative changes in the sexual cells. Students of the subject are at present engaged in a more thorough investigation of this vitamin and its possible use in medical conditions affecting human beings.

Vitamin K—Vitamin K, although a quite recent discovery, has already been found of great value in the treatment of conditions characterized by *hemorrhage* (bleeding). This factor is needed for the *coagulation of the blood*. In diseases of the liver or in instances where the blood is laden with an excess of bile, the so-called *prothrombin* (protein element concerned in the process of blood clotting) level of the blood is decreased and consequently the coagulation time is prolonged. Vitamin K will aim at overcoming this prothrombin deficiency and shortening the coagulation time, thus reducing the tendency toward bleeding. This vitamin is found in liver, fat from cattle and pigs, egg yolk, soy beans, green vegetables, certain grasses, and alfalfa. It has recently been synthesized by various drug houses and may be given by the mouth or by injection.

CHAPTER XVII

Parasites Which Produce Digestive Disturbances

MANY PARASITES and worms are found within the digestive canal. Some reside in the stomach and bowels, others in the liver or gall tract and occasionally within the pancreatic ducts. Some worms, such as threadworms in children, congregate in great number just within the anus. The organisms exist within their victims either as mature parasites and worms or as premature forms—larvae (maggots) or ova (eggs).

Tapeworms—There are five common types of tapeworms (*taenia*): *Taenia saginata*, also known as *Taenia mediocanellata*; *Taenia solium*; *Bothriocephalus latus*; *Taenia nana*; and *Taenia cucumerina*.

Taenia saginata is the most common variety found in this country. It usually enters the body through the eating of *diseased beef*, and is identified by its head, which has four powerful suction disks but no hooks. The separate segments of which the worm is composed are usually much longer than they are broad. These segments or proglottids, when they mature, are easily separated from the main body of the worm and are frequently found in the stool or bowel excrement (waste). The ova (eggs) of this worm are also eliminated from the body of the worm and can be seen in the stool in considerable number. These eggs are oval in shape and have certain characteristic features which under the microscope aid in the diagnosis.

Taenia solium is a type of tapeworm acquired through the ingestion of *diseased pork*. Its head also has suction disks and two rows of hooks. The top of the head is slightly pigmented. The body also is composed of a series of segments. It is a shorter worm than the one above described and its separate segments also are shorter. The ova or eggs of this worm are found in the stool and are similar in appearance to those of *Taenia saginata*.

Bothriocephalus latus is a tapeworm which usually is found in the people of nations where large quantities of *raw fish* are eaten. It is the longest of the tapeworms, being many yards in length, and may

consist of hundreds or thousands of segments. Its head is club-shaped, with two suction disks on the sides. The segments are short but broad. The exceptional width of the segment is characteristic of this worm. Eggs are often found in the stool but individual segments are seldom seen. Occasionally a large part of the worm is found.

Taenia nana is the smallest tapeworm known. It is found in this country, and is approximately 0.4 inch to 2 inches in length and 1/100 to 4/100 inches wide. It has a bullet-shaped head with suction disks and hooks. The segments near the head and in the upper body are small and short, whereas those toward the tail end are larger and broad. The stool often contains both eggs and segments which are not readily recognized except by microscopical examination.

Taenia cucumerina is less prevalent than the former types. It is rather small, about 8 to 14 inches long and about 0.08 to 0.1 of an inch wide. The head is covered with small hooks, and the segments are also passed in the stool, resembling cucumber seeds in appearance. Infection by *Taenia cucumerina* may originate from *dogs* and *cats* which carry the parasites and ova in their bowel tracts. Children who associate or play with animals may thus become infected directly by the animal or by its contaminated excrement.

In all of these tapeworm infections, the mode of entrance into the body is through an intermediate host which becomes infected by the original ovum. This ovum or egg develops into a *cysticercus* (maggot surrounded by tissue and resembling a sac in appearance) in some part of the flesh of the animal and, when eaten by a human being, finds its way into the digestive organs. Here the *cysticercus* develops into the parasite, which gradually matures as time goes on, usually in three to four months.

As a rule, only one tapeworm will infect the bowel tract of an individual, but there are exceptions when a number of worms may do so. Occasionally a careless person of unhygienic habits reinfects himself through the blood stream and, as a result, *cysticerci* may reach his own body tissues and such organs as the brain, muscles, skin, and eyes.

The tapeworm is usually located in the upper third of the small intestine, to the lining of which the head of the worm is intimately attached. The remainder of the parasite is usually distributed throughout the lower loops of the small bowel. The lower segments of the parasite will often break off and be found in the stool.

Symptoms are lacking in many instances, except for the presence of segments of the tapeworm in the stool. In other cases, such symptoms as loss of appetite or increased appetite, mild or severe attacks

of abdominal pain, nausea, vomiting, constipation, diarrhea, weakness, dizziness, headaches, general lassitude, and mental irritability may, in part or in combination, present themselves. Occasionally such additional symptoms as itching of the nose, increased salivation (watering of the mouth), palpitation of the heart, and convulsions may occur. These various symptoms are due either to reflex nerve influences created by the parasite or to toxic irritation from poisonous substances resulting from its presence in the body. Often the blood, upon examination, will reveal abnormalities indicating the influence of a toxemia. *Eosinophilia* (an increased number of specific white cells known as eosinophiles) and *secondary anemia* are characteristic of such changes as are frequently found in infections with the tapeworm *Bothriocephalus latus*. This worm is believed to excrete a poisonous substance into the intestinal tract of its human host, and this substance, upon absorption by the individual, results in the creation of toxic effects.

When the ovum (egg) enters the body and develops into a *cysticercus* (maggot surrounded by tissue and resembling a sac in appearance) it may, through its mere presence in certain tissues, give rise to symptoms which will vary in accordance with the location affected. When the brain is the site of lodgement of the cysticercus, such symptoms as headache, dizziness, convulsions, epileptic seizures, and mental disturbances may occur. When the cysticercus lodges in the muscles of the body, aches and pains frequently occur in the involved areas. Individuals who discover the presence of whitish or grayish flat particles in their stools should have this material examined to ascertain if they are shed segments of the tapeworm. More complete examination of the fecal excrement may reveal the presence of eggs, and this further clinches the diagnosis.

The treatment of tapeworm infection has as its primary object the elimination of the worm. This is accomplished by narcotizing or paralyzing the parasite and then eliminating it, or by attempting to destroy the worm within the host's bowels. Usually the individual is asked to limit his diet for a few days, and to take a mild purgative (medicament aimed at emptying the bowels), to be followed the next day by a vermifuge (medication to expel worms) indicated for the specific condition. Various preparations may be employed, but only under the guidance of a physician. *Male fern root* is commonly used in proper dosage. Improper employment of this drug may result in poisoning. Some hours after the preparation is given, it is wise to follow with an active cathartic to remove this medicament from the system. It is important,

after the treatment is given, to ascertain whether the entire worm has been removed. The head, which is usually attached to the intestinal wall, should be sought for in the stool after the treatment has been given.

Trichinosis—Trichinosis is a disease resulting from infection by *Trichinella spiralis*. This organism is a small, worm-shaped parasite about an eighth of an inch long. It usually enters the body through the eating of raw or *improperly cooked pork* or pork foods. The parasites as a rule are imbedded in the muscular tissue of the porker. At times the larvae (maggots or premature form) may contaminate other foods and thus be ingested. After the parasites enter the bowel of their human host, they develop into mature organisms within a week or more, and new generations again form. These parasites may migrate throughout the body muscles or become encapulated and undergo calcification (hardening or petrification by deposits of lime salt). In exceptional instances they enter the brain substance and do considerable harm. These organisms are rarely found in the blood or stool.

The symptoms are often general because of the widespread character of the disease. Fever, general lassitude, aches, pains, headache, loss of appetite, nausea, vomiting, and diarrhea are usual. In addition, muscle soreness and cramps affecting the limbs, thorax, and abdomen are common complaints. The involved muscles will often reveal swellings and pain upon movement. The joints are frequently swollen and tender. In instances where the brain is involved, serious symptoms usually arise depending upon the exact location affected. Dizziness, convulsions, mental disturbances, and paralytic manifestations often occur. The blood, because of toxic influences, may evidence eosinophilia (an increased number of specific white cells known as eosinophiles) and secondary anemia.

The treatment aims at the annihilation of the infection, if possible, and elimination of the parasites from the body. This is attempted by means of thorough cathartics for a period of four or more days, to be followed by a vermifuge such as male fern or santonin under a physician's direction. Occasionally salvarsan or its derivatives are administered intravenously. Quinine, in large dosages, has also been employed by some authorities. One must guard against damage to the body from the effects of the medication. Such complications as anemia and nerve-system disturbances may require special consideration.

Hookworm Disease—Hookworm disease, although most prevalent in our southern states, is also seen in other parts of the world. The

parasite which causes this disease is the hookworm, also known as the *Ancylostoma duodenale*. This organism consists of a head, with a mouth usually containing four front teeth and two rear teeth, and a body. The American hookworm has a different mouth arrangement from the worm just described and is known as the *Uncinaria americana*.

Infection may occur through the ingestion of food contaminated with the ova (eggs) of the parasite, through transference of the infection to the mouth by infected fingers, or through the penetration of the skin by the organism—from the skin, in this case, the parasite enters the blood system and is conveyed to the small intestine, where it establishes residence and multiplies. The organism attaches itself very securely to the intestinal wall, thus deriving nourishment by blood suction. The points where the organism is attached may ulcerate, and the intestinal wall near by is usually inflamed.

The symptoms are varied and many, but the outstanding sign is *anemia*, the result of blood sucking by the hookworms and of possible auto-intoxication due to the presence of created poisons. The first symptoms will often occur in the hands and feet as an eczematous eruption, with itching, following the contact of the hands and feet with infected earth (earth contaminated with larvae). About five weeks after the onset of the infection, the larvae will have reached the small intestine, where they develop into worms. These worms, through their blood-sucking activities and other harmful influences, produce various grades of anemia, catarrh of the intestines, and possible ulcerations. Such symptoms as dizziness, languidness, headache, fever, respiratory difficulties, palpitation of the heart, and loss of strength may occur. In addition, digestive complaints such as increased or reduced appetite, pain within the mid-abdomen, colic, diarrhea or constipation, and the passage of blood and mucus in the stool will often be experienced. The longer the duration of the disease, the more pronounced the anemia usually becomes. The blood will give evidence of characteristic changes, especially eosinophilia (an increased number of specific white cells known as eosinophiles) usually found in worm infections.

In cases of long duration *disturbances of the nervous system* may arise, such as mental and physical sluggishness, retarded physical development, disorders of sensation in the skin of various parts of the body, and disorders in nerve reflexes. The skin and hair are often dry, and perspiration is lacking. Loss of flesh is often noticeable, and the face, body, or limbs may be edematous (dropsical). The disease may last for months or years depending upon the quality of medical atten-

tion given. Some patients suffer little or no ill effects, whereas others become very sick. The stool, upon examination, will usually reveal large quantities of ova (eggs), and in cases of hemorrhage considerable blood may be found.

The treatment aims principally at destroying the worms and eliminating them from the body. Cathartics such as Epsom salts and castor oil are employed, but in addition such vermifuges as thymol, oil of chenopodium, or carbon tetrachloride are given in proper dosage. Following treatment, the stools are constantly examined for weeks to insure the absence of eggs and worms from the bowel tract. Other medicaments to correct prominent and untoward symptoms may be employed. Advice as to the prevention of reinfection and contamination should be given.

Round Worms—Round worm, known also as *Ascaris lumbricoides*, is a worm which resembles a goose quill in size and appearance. It is about an eighth of an inch in diameter. The female worm may contain within its genital organs millions of ova (eggs), which are found in great quantity in the stools of the victims of this infection. The infection occurs frequently in children and is confined chiefly to the small intestines. Occasionally these worms, which are hatched out in the intestine after the egg has been ingested with contaminated food, will migrate to other organs of the body such as the stomach, gall ducts, liver, pancreas, and respiratory organs.

Frequently individuals infected with this worm present no symptoms whatever, but in other persons a variety of symptoms of mild or severe degree may occur. These are itching of the nose and skin, urticaria (hives), hypersalivation (watering of the mouth), lassitude, headache, pains in the abdomen, nausea, vomiting, and diarrhea. In a few instances dizziness, convulsions, and mental disturbances arise. It is possible that toxic or poisonous substances are created by the organisms, and these poisons may bring about some of the above manifestations. When the worms migrate from the intestine to other organs, additional symptoms due to their presence in these localities often occur, such as interference with breathing, choking sensations, jaundice, and localized pains. A massing together of the worms into a large ball may occasionally produce an intestinal obstruction with severe symptoms.

In these infections, the stool will usually reveal the presence of the worms or large numbers of ova. The blood examination will also, as in other parasitic infections, show an eosinophilia (an increased number of specific white cells known as eosinophiles).

The treatment embodies the administration of a vermifuge such as santonin or oil of chenopodium, to be followed by a cathartic such as castor oil, and an enema if necessary. Other measures to correct troublesome symptoms are often required.

Pin or Threadworms—Pin or threadworms (*Oxyuris vermicularis*) are small white thread-like worms frequently found in children. The ova of this parasite, having been ingested with contaminated food, reach the stomach, where they are readily transformed into the embryo stage, and thence are transmitted onward to the intestines, where they develop into mature worms. They migrate throughout the intestinal tract toward the rectum, where they accumulate in great numbers.

The symptoms, except for itching about the anus due to the infection in the rectum, are usually insignificant if present at all. Occasionally rabid appetite, itching of the nose, dizziness, nausea, diarrhea, anemia, and nervous irritability occur. Itching and burning about the anus are often pronounced and may result in local skin infections or vaginal infections in girls. The child, by contaminating its fingers, may reinfect itself after treatment, by carrying the eggs to the nose or mouth. The stool, upon examination, will reveal either the worm or eggs in its content.

The treatment usually embodies mild catharsis and the weaker vermifuges, with daily enemas consisting of salt water, weak vinegar solution, or weak tea. Grated raw carrots as food are believed to be beneficial. Simple liquid or semi-liquid food is adhered to during treatment, and warning against reinfection by contaminated hands is stressed.

Fluke Worms or Trematodes—Fluke worms or trematodes are usually found in the lower animals, but rarely in human beings. The infection is more common in Asia than elsewhere. The worms are about half an inch long and have a sucking mechanism. There are several varieties. One form, *Distoma haematobium*, produces a disease known as *bilharzia*, which is seen occasionally in tropical countries. In this ailment, the organisms are found in the liver and its circulation, the intestines, and the genito-urinary organs. At times they migrate to other organs. In the various locations where the parasites lodge themselves, irritation occurs which may give rise to symptoms referable to the respective organs. These symptoms may be mild or severe. Fortunately this is a rare ailment.

The treatment advocated aims at destroying the parasite at its point of lodgement. Intravenous medication in the form of antimony and

sodium tartrate is employed, as are other preparations which have the same objective. Catharsis and mild vermifuges may also be tried. Such medication as appears indicated to correct distressing symptoms should be employed.

Whipworm—Whipworm is known among medical authorities as *Trichocephalus trichiurus*. It is about two to three inches in length and resembles a whip in appearance. The fore part of its body is of a thin, thread-like consistency, but its hind part is much thicker. The infection often originates through direct contact with soil which has become contaminated with the whipworm ova or larvae, or through the ingestion of vegetables or foods which have been grown in this soil. After the ova or larvae are ingested, the worm after a period of incubation will develop within the large bowel. The first portion of the large intestine is the usual habitat of this organism. Here the worm attaches itself firmly to the bowel lining, and through its sucking apparatus derives nourishment. The eggs of the worm are readily found in the stool, but the worm itself is seldom seen in this waste matter.

The symptoms here, as in other parasitic infections, are sometimes absent, but again they may occur in mild or severe forms. Abdominal pain, cramps, and diarrhea may occur, with or without fever. In some cases blood is found in the stool, and pronounced anemia occurs because of the blood-sucking activities of the worms and possibly also because of the toxic effects resulting from the poisons produced by the parasite.

The treatment consists in employing cathartics and such vermifuges as thymol, chenopodium, or carbon tetrachloride by the mouth, as in the case of other infections, and, if this is not successful, following it up with special medicated enemas daily.

Lamblia *Intestinalis*—*Lambli*a *intestinalis* is a pear-shaped parasite with a number of flagella (hair-like processes) attached to its body. The disease it produces is referred to as *lambl*iasis or *giardiasis*. The organism is usually located in the upper portions of the small intestine, but occasionally it enters the bile tract. Children are its usual victims. At times the infection creates no symptoms, but again there may be mild or severe symptoms referable to the intestinal tract.

The treatment, which aims at annihilating the parasites, consists of sulphur or arsenical medication, together with catharsis from time to time.

Anguillula *Intestinalis*—*Anguillula* *intestinalis* is a very small worm, about one-sixteenth of an inch long, which resides in the large intestine. When viewed under a magnifying glass it reveals a rounded

head with a mouth and prominences, probably indicating sucking disks. This organism produces many eggs, which may be found in the stool. As with other infections, symptoms may or may not manifest themselves. When they do occur, abdominal pain and diarrhea are prominent.

The treatment indicated involves the use of such vermifuges as thymol, chenopodium, and carbon tetrachloride. Enemas of glycerin or olive oil may also prove valuable.

Myiasis Intestinalis—Myiasis intestinalis is a condition resulting from the ingestion of contaminated food. It is believed that insects, particularly flies, deposit their eggs or larvae upon this food and that these elements develop into parasites within the bowel. The symptoms resulting from the infection are either mild or severe. When they are severe, intestinal catarrh and ulceration usually occur, which in turn may give rise to local abdominal complaints and general symptoms such as fever.

As in other infections, the treatment requires catharsis and vermifuges similar to those already mentioned above.

Cercomonas Intestinalis and Trichomonas Intestinalis—These are small, pear-shaped parasites with flagella (hair-like processes) attached to their bodies fore and aft. They often exist within the bowels without causing symptoms, but again they are capable of irritating the bowel, thus producing a catarrh and possible bleeding due to ulceration. Such symptoms as abdominal pain or colic and diarrhea may occur. Pronounced anemia is sometimes present, and upon examination the blood evidences eosinophilia, which is characteristic of parasitic infections. Two other parasites similar to those just described are the *Tetramitus mesnili* and *Waskia intestinalis*. These organisms, although normally not of a disease-producing character, may occasionally produce symptoms. They are frequently found in the stool.

The treatment embraces the use of cathartics and mild intestinal vermifuges or intestinal antiseptics. Enemas are also employed occasionally.

Coccidiosis—Coccidiosis is a disease due to an infection with a small, round organism known as the *coccidium*. It is frequently seen in the lower animals, but rarely in human beings. The infection as usual is acquired through ingesting contaminated food which has been spoiled by the parasite itself or by its cyst form. The parasite lodges within the intestines, but also occasionally enters the liver. The symptoms are due to bowel irritation and are usually mild pain and diarrhea. The stool reveals cysts upon examination.

The treatment, as in other similar infections, requires the use of cathartics and intestinal disinfectants.

Balantidium Coli—This, like the amoeba, is a protozoan type of parasite but much larger in size. Under the microscope it appears as a large oval cell covered with wave-like cilia (hair-like processes), and the body substance is composed of granular material, fatty substances, blood cells, and other elements. It has a mouth at its fore end and an anus at its rear. This parasite often lives in the bowels of *swine*, and individuals become infected through contact with these animals or by eating the meat, which contains the encysted (surrounded by a membranous sac or bag) forms of this organism. These cysts enter the human large bowel, where they develop into the mature parasites.

The symptoms come on slowly and at first are rather mild, in the form of a simple diarrhea. As time goes on, the condition becomes more severe because of the usual manifestation of ulcers through the colon. The symptoms include all forms of indigestion, such as loss of appetite, belching, bloating, pain in the pit of the stomach or other parts of the abdomen, loss of weight, skin dryness, loss of strength, pain throughout the body, anemia, and fluid (dropsy) in the lower limbs. The diarrhea may become more severe and may alternate with constipation. The stool contains considerable mucus and blood and is offensive in odor. The bowel is often distended and tender upon abdominal examination. The stool upon investigation will reveal the parasite itself within its own cyst. Upon examining the rectum and sigmoid flexure through a sigmoidoscope, the evidence of ulceration is usually apparent. A study of the blood evidences eisinophilia and reactions characteristic of parasite infection.

Treatment, as in similar infections, incorporates the use of various vermifuges such as thymol and methylene blue. Internal medication by the mouth or injections of preparations such as emetin, ipecac, salvarsan, and arsenic are also employed. Irrigations of the bowel with antiseptic solutions of iodine, silver, or quinine may prove beneficial. A proper diet to curb the diarrhea is necessary. Rest in bed and other measures to control symptoms are usually advisable.

CHAPTER XVIII

The Diet in Digestive Diseases

Diets, when prescribed for disorders in the digestive system, have as their chief objective the correction of digestive difficulties by lessening the tasks imposed on the diseased organs, but they also aim at supplying food that will be sufficiently varied, appetizing, and nutritious. This is accomplished by assembling food substances which contain proper quantities of *proteins, carbohydrates, fats, and mineral salts*. When properly prepared, such a diet should make digestion and absorption much easier.

Some foods such as milk, eggs, cream, fruits, and oils are often taken in their raw or native state, and in healthy individuals these are disposed of by the digestive system with little or no difficulty; but in many ailing persons some of these foods cause distressing symptoms. Other foods consisting of protein, carbohydrate, and fat, of which there are many, are usually not eaten raw and are regarded as indigestible in that state. It is necessary, therefore, in order to render foods more easily digestible and assimilable, to resort to such preparations as boiling, baking, broiling, roasting, chopping, puréeing, extracting, and crushing. In addition, other measures are at times taken to make the various foods more appetizing and appealing to the eye.

To render foods more easy to digest they are often mashed or puréed. This enables the ingested food to be more readily chewed and digested by the various digestive juices—the saliva in the mouth, the gastric juice in the stomach, and the bile, pancreatic, and intestinal juices in the bowel. In mashing or puréeing, the coarse framework and parts of the food which are difficult to digest are softened or removed with a sieve beforehand. The various digestive juices will penetrate the puréed foods more easily. When this type of preparation cannot be accomplished, it may benefit the patient if such articles as fresh or coarse bread, coarse vegetables, and raw fruits are removed from the diet. Some individuals who have stomach or bowel disturbances do

not tolerate milk in its natural state; they must either drink such substitute fluids as sour milk, buttermilk, and yogurt or add lime water or citrate of soda to the milk to render its curd more easily digestible.

Protein foods are represented chiefly by meats, eggs, cheese, and fish. They contain protein, fat, water, and mineral salts. *Carbohydrate foods* are represented by bread, cereals, vegetables, fruits, and sugars. They contain chiefly carbohydrates, a relatively small portion of protein, a very small amount of fat, water, and mineral salts. *Fat foods* are represented by butter, cream, lard, gravies, and oils. They contain a large quantity of fat, water, and mineral salts.

In addition to the fact that foods contain protein, carbohydrates, fat, and mineral salts, most of them also contain *vitamins*. This last constituent has been referred to as an *accessory food factor* and as a *food hormone*, because of its vital effects upon nutrition. The vitamins differ in their activities and are designated either by letters as vitamins A, B, C, D, and E, by numbers as vitamins B₁, B₂, and B₆, or by names as riboflavin, pyrodoxin, pantothenic acid, ascorbic acid, and so on. The importance of these various vitamins to the body has already been indicated in a previous chapter dealing with deficiency diseases, and the need for these substances in the diet in sufficient quantities to maintain good health and to prevent disease cannot be overemphasized.

In the arrangement of diets for the treatment of digestive disorders, foods which will agree with the digestive system should be prescribed. The condition of the stomach, bowels, liver, gall bladder, and pancreas must be borne in mind. In stomach or intestinal disorders, only foods which will not irritate or overtax the stomach and intestinal linings are to be ingested. The type of the disorder will primarily influence the selection of the foods. In severe inflammations, only bland liquid foods are indicated. In moderate inflammations or catarrh, the use of semi-solid and liquid foods is usually advocated. In mild catarrhs of the stomach and bowels, the semi-solid and bland solid foods are usually tolerated.

When the stomach lacks acid and the proper ferments, as is often the case, meats and other coarse foods are to be reduced or interdicted entirely, depending upon the degree of stomach defection. In such cases the foods are usually well ground up, particularly the meats. In patients suffering from diarrhea, certain foods are either left out of the diet or so treated as to make them more amenable to digestion. In instances of stomach or intestinal hemorrhage, only liquid foods should be employed for a time, and in serious cases feeding by the mouth may have to be given up entirely for a long period, during which

feedings may be instituted intravenously (into the vein direct), hypodermically (under the skin tissues), or rectally (into the rectum in small quantities).

The diet, of course, is varied in accordance with the changes in the patient's condition. In severe cases, as stated above, no food by the mouth or only simple liquid foods are given. With improvement, richer or more nutritious liquids and semi-solid foods are added, until finally more solid food may be utilized. Gradually the diet is increased to correspond with the improvement in the condition of the patient.

Since in every individual case symptoms vary considerably, the diet must be regulated accordingly. Some ulcer cases require one type of dietary; others, with symptoms of bleeding or profound spastic pain, require other types. In other words, the diet is arranged to suit the particular case. Naturally the general condition of the patient must always be considered before stressing the local digestive disturbance in the arrangement of a dietary. Foods devoid of irritating qualities and easily assimilable, often referred to as smooth, bland articles in the diet, are the types to prescribe in most digestive disorders.

Outstanding examples of irritating or coarse foods usually excluded from dietaries in digestive cases are: fatty, greasy foods and gravies, pork, smoked and salted meats, lobster, crab, many forms of delicatessen, rich pastries which contain much butter or fat, coarse and fibrous vegetables, most raw fruits, raw salads, alcohol, various liquors, strong coffee or tea, condiments, spices, and nuts. However, as the digestive condition improves over a period of time, some of these foods may occasionally be added in small quantity, upon the order of the physician, but it is never wise for a sufferer from digestive disorders to return indiscriminately to the ingestion of the above foods.

Knowing just which foods are to be interdicted in the particular case, it then becomes the problem of the medical adviser to prescribe a diet consisting of the non-irritable, rather easily assimilable foods, in sufficient quantity and containing enough caloric value to enable the individual to carry on. In addition, in view of the knowledge acquired in recent years, the vitamin value of the foods should approximate the requirements set for the average needs of a human being, and should include all of the vitamin factors essential to well-being.

The average man or woman requires a diet capable of furnishing from 2,500 to 3,000 calories a day, to supply the necessary energy in the performance of ordinary duties involving fair activity. The *calorie* is the unit used for measuring food combustion; knowing the caloric value of one gram of each of the fundamental food elements—carbohy-

drates, proteins, and fats—the caloric or fuel value of all foodstuffs is easily determined. The fuel value of carbohydrates per gram is 4.1 calories; of protein 4.1 calories; and of fat 9.3 calories. Knowing the composition of each food by proportion and weight, it is easy to estimate its caloric value. For example:

100 grams of lean beef contains 18 grams of protein, 25 grams of fat, 56.2 grams of water, and 0.8 grams of mineral salt.

Since only the protein and fat are combustible, it may be shown that the beef produces 306.3 calories, estimated as follows:

18 grams protein produce 18 times 4.1 calories, or 73.8 calories; 25 grams of fat produce 25 times 9.3 calories, or 232.5 calories; added together, these amount to 306.3 calories of heat.

Likewise, 100 grams of cheese, in addition to mineral salts and water, contain 25 grams of protein, 30 grams of fat, and 2.5 grams of carbohydrate. The caloric value, therefore, is 102.5 plus 279 plus 10.25, or 391.75 calories.

100 grams of vegetables, on the average, contain 1.5 grams of protein, 1 gram of fat, and 8.0 grams of carbohydrate. The caloric value, therefore, is 6.15 plus 9.3 plus 32.8, or 48.25 calories.

In this manner the approximate caloric value of all foods may readily be determined.

In addition to the above-mentioned factors which are considered in the formulation of a dietary regime, it is of the highest importance to take into consideration the *vitamin factor*. Fortunately the ordinary food supply of most persons is sufficiently varied to preclude a deficiency of any one vitamin, but in the treatment of diseased conditions it is often necessary to impose a dietary containing a reduced or limited amount of certain vitamins. Also, to offset disturbances due to a lack of this factor, vitamins may have to be given separately in concentrated form, aside from the food. The harmful effects of vitamin deficiency have been discussed in Chapter XVI.

When considering foods for their vitamin content, it is important to have a knowledge of those which contain large quantities of each variety. Vitamin A is found in milk, egg yolk, cream, butter, cheese, lettuce, beans, carrots, salmon, bananas, prunes, peaches, apricots, and cod-liver oil. Vitamin B, with its associated complex factors, is found in wheat germ, cereals, eggs, beef, liver, oysters, bread (particularly whole-wheat bread), salmon, prunes, oranges, carrots, lettuce, spinach,

yeast, and tomatoes. Vitamin C is found in fruits and vegetables, such as lemons, oranges, limes, tomatoes, apples, apricots, peaches, leafy vegetables, carrots, parsnips, peas, beets, asparagus, and bananas, and in liver. Vitamin D is found in butter, cream, egg yolk, salmon, tuna fish, and cod-liver oil.

A diet recommended for an ordinary man doing fairly active work should have a caloric value of at least 3,000 calories, and the vitamin values should be as follows:

Vitamin A—5,000 international units

Vitamin B₁—1.8 to 2.3 mg.

Vitamin B₂, riboflavin—2.7 to 3.3 mg.

Nicotine acid—18 to 23 mg.

Vitamin C—75 mg.

Vitamin D—minimum amounts

In *diseased conditions*, however, it is not always possible to give individuals a diet which supplies both the needed caloric value and the necessary vitamin content. Fortunately the duration of time in which persons are restricted to a limited diet is not usually prolonged, and a change to dietaries which approach the normal ordinary type is made as early as possible.

In *diseases of the mouth and gullet*, particularly the acute conditions, simple liquids of a non-irritating nature are best. These consist of milk, soups, bouillon, strained cereal gruels, weak tea, weak coffee, postum, barley or rice water, buttermilk, orange albumen, milk punch, peptonized milk, and the like. As the condition improves, semi-fluid foods are gradually added, such as jello, milk toast, raw eggs, cooked cereals, soft boiled eggs, and cocoa. Upon continued improvement, mashed potatoes, toast, chicken, apple sauce, baked apple, custard, junket, puréed vegetables, and so forth, are taken. As time goes on and with steady improvement, more solid foods such as fish, chopped meats, and various vegetables and fruits are added to the diet.

In *diseases of the stomach and intestines*, a diet which will not overtax these organs or subject them to irritation should be prescribed. The physician should be thoroughly acquainted with the functioning of the individual's stomach and bowels—information acquired through the history and by physical examination, stomach or bowel tests, X-ray studies, and so on—before resolving upon a dietary regime for his patient. Every case is a separate entity, and no fixed dietary standard is a proper procedure to follow. On the contrary, all cases need individualization in accordance with the medical findings, the sensitiveness of

the patient to foods, his customs and habits of eating, and such other considerations as pertain to the problem.

When there is a *delay in stomach emptying*, bland, non-irritating foods which are known to leave the stomach with comparative rapidity are used, such as milk, stewed fruits, gelatine, light puddings, and thin cereals. Meats and fat foods, which leave the stomach slowly, are usually avoided in such cases. On the other hand, when food leaves the stomach too rapidly, meats and fats are occasionally advised. Emptying time, however, is not always the chief factor to be considered in stomach conditions. In fact, *irritability, spasm, and secretory conditions* play an even more important role in most cases.

An *irritable stomach*, as characterized by distress, pain, nausea, bloating, belching, and vomiting, especially if the condition is acute, may interdict food entirely for twenty-four to forty-eight hours. As symptoms improve, the slow, gradual administration of such simple fluids as water, weak tea, seltzer water, and cracked ice may be allowed. Then, with further improvement, liquids such as milk, cereal broths, and gruels are given, to be followed later with soft bland foods, such as toast, milk toast, rice pudding, tapioca pudding, baked potato, soft boiled eggs, poached eggs, baked apple, and apple sauce. Upon decided improvement, such tender protein foods as lean fish, lean chicken, and lean boiled ham may be added to the diet.

In persons with an *oversecretion of acid juice and ferments* in the stomach, fruit juices or acid fruits such as orange, pineapple, and grapefruit will most likely disagree, whereas individuals with a reduced secretion of acid juice and ferments may welcome such foods. Protein foods, properly prepared, usually agree better with the former type of patient than with the latter.

In persons suffering from *ulcer* of the stomach or duodenum, the diet should conform to the demands made by the general and local conditions created by this lesion. When the irritation is so pronounced as to cause great pain, simple liquid food may of necessity be required at the start. When bleeding is pronounced, mouth feedings may have to be prohibited for many days, only to be allowed following decided improvement and cessation of the bleeding. In some instances rectal feeding, intravenous feeding, and hypodermic administration of liquids are often resorted to for many days. In other cases feeding is performed through a tube which leads far beyond the stomach into the small intestine. For years milk and cream have been outstanding foods in the treatment of ulcer, and they still are in the treatment of the early stages of this disease; but it is advisable to add a variety of other well-

prepared, bland, easily digestible foods to the diet as soon as possible, to offset nutritional disturbances that often develop in such patients.

Persons who suffer from *spasm* of the stomach outlet must depend upon liquid, non-irritating foods until the spastic condition is overcome, when semi-liquid and more solid soft foods may gradually be added. In individuals with a low or so-called "dropped" stomach, or an enlarged or dilated stomach, small amounts of semi-liquid or soft foods at frequent intervals are better utilized than large feedings at longer intervals. This does not overburden the stomach, and it will enable the organ to evacuate its contents more adequately.

In *intestinal diseases* the diet to be prescribed will, in great measure, depend upon the nature of the disturbance and the underlying causes. In *diarrhea* the food should, of course, be soft or liquid, and should tend to have an astringent (causing contraction of the tissues) effect upon the bowels. Fruits and vegetables are to be omitted in acute manifestations of this condition; but, as definite improvement occurs, these foods may gradually be added to the diet after the coarse framework and irritative coverings are removed. Meats usually irritate the bowels, and for that reason are omitted from the diet in diarrheal conditions. In *starch dyspepsias*, where considerable fermentation with the production of gas occurs, certain carbohydrate foods are either left out of the diet or reduced to a minimum; such foods include sweet fruits, candies, sugars, pastries, coarse cereals, and coarse vegetables. In intestinal *dyspepsia* associated with *putrefaction* (protein decomposition), meats and eggs are removed from the diet or reduced to a minimum. In *colitis*, coarse and irritating foods of all types are to be avoided. In some forms of *constipation*, especially the *spastic* type, foods with little residue but with a definite laxative or lubricating effect should be employed; these consist of fruits (raw, dried, and stewed), honey, and olive oil. Mineral oil is used, but it is not a food. In *atonic constipation*, on the other hand, foods containing considerable coarse structure or roughage, such as bran, whole wheat, agar, fruits, and some fats, are regarded as beneficial because of the stimulating effect they exercise upon the intestine.

In *diseases of the liver and gall tract*, various reflex disturbances in function often arise and affect the stomach and bowels. A study should be made regarding the integrity of the liver, gall bladder, gall ducts, and pancreas. When the *liver* is diseased, its ability to metabolize food is interfered with to a certain extent, and some of the food elements that are inadequately disposed of may act as toxic substances. This is true of protein foods, especially meats. Fats also may suffer from im-

proper digestion in liver and gall-tract disorders and are therefore in great measure to be avoided in such ailments. Carbohydrates, which are more readily digested and absorbed, are indicated in these conditions; hence a diet consisting of vegetables, cereals, and fruits in proper form and preparation is to be employed. Fats and greasy foods are contra-indicated, and only the occasional use of a vegetable oil, such as olive oil, is allowed. Alkaline or mineral waters may also prove beneficial in these cases, by neutralizing the stomach juice and by stimulating a more normal flow of bile in cases of liver and bile-tract congestion. In recent years the use of stewed fruits, fruit juices, and cereals has gained wider application in the treatment of the severe or acute liver ailments. Lean meats and the white of eggs (albumen) are employed in conjunction with carbohydrates in the less acute liver disorders. The condition of the stomach and bowels must be fully considered when arranging a diet for liver and gall-tract disorders, because of the frequency with which those organs are involved in such affections. Cases in which the *gall bladder and ducts* are chiefly involved may have a fair quantity of protein and carbohydrate food, but only a limited or minimal amount of fat. Very starchy foods, however, should not be taken in excess. Rich pastries, pies, hot breads, condiments, and liquors must be avoided.

In *diseases of the pancreas*, when the secretion of this organ is reduced, such foods are to be taken as would ordinarily not require much digestive action by the pancreatic juice. Protein, fats, and coarse carbohydrates should therefore be avoided. Only simple, bland, readily digestible, and easily assimilable foods are indicated. Predigested proteins and predigested starches are used in severe cases. With improvement, properly prepared bland proteins and carbohydrates are gradually added. Fat should be removed as much as possible from the dietary of these sufferers.

The author employs the following diet as a base from which he removes, or to which he adds, foods in accordance with the requirements of the condition presented by his patients. This diet is known as the *fundamental stomach diet*, and may be used in many digestive disturbances as it is, without variation. As indications arise, it is modified to suit each individual case.

FUNDAMENTAL STOMACH DIET

FLUIDS	Plain water, rice water, barley water, albumen water, orange juice, milk, buttermilk, malted milk, cocoa, kumyss, whey, cream (sweet), sour cream, weak tea, postum—1 cup or glass. Clear purée soups (chicken, barley, farina, rice, asparagus, pea, potato, celery)—1 plate. Clam broth, vegetable broth, oyster stew, plain bouillon, bouillon with egg—1 plate.
CEREALS (well-cooked)	Farina, wheatena, hominy, rice, shredded wheat, puffed rice, corn flakes, post toasties, cream of wheat, oatmeal—1 medium serving.
BREAD	Stale only—toasted, white, rye, graham, gluten, bran—2 or 3 slices.
EGGS	Boiled, poached, or coddled—1 or 2.
FISH	Fresh—boiled or broiled—1 medium serving.
MEATS	Chicken or lamb chop—1 medium serving.
VEGETABLES (purée)	Peas, potatoes, macaroni, parsnips, spaghetti, squash, string beans, buttered beets, carrots, spinach, asparagus—ordinary serving (choice of two or more).
DESSERTS	Junket, custard, gelatin jellies, blancmange, tapioca, cornstarch, rice pudding, bread pudding, oranges, stewed fruits (apples, apricots, prunes, pears, peaches), cream cheese, olive oil—ordinary portion (choice of one or two).
<i>Avoid</i>	Fluid too hot or too cold. Coffee, tea, beer, liquor, tobacco. Very sweet or sour foods, fried or greasy foods. Condiments such as vinegar, mustard, pepper, pickles. Seed fruits—huckleberries, strawberries, pineapples. Coarse foods such as cabbage, onions, turnips, cauliflower. Hot or coarse breads, pies, cakes, candies. Smoked meats, herring, salmon, fat meats, duck, goose. Hard-boiled eggs, cheese, nuts.
<i>Observe</i>	Cut food finely, chew thoroughly, eat slowly.

Glossary

ABDOMEN—Belly, or body cavity bounded by the diaphragm above and the pelvis below.

ABSORPTION—The taking into the tissues, through the medium of the lymphatics or blood vessels, of any material in suitable form.

ACHYLIA—A condition characterized by the absence of the gastric juice or other digestive ferments.

ACUTE—A short and sharp course, not chronic.

ADENOMA—A benign growth of the same structure as the tissue in which it originated.

ADHESION—A band resulting from the exudation of fibrinous material due to injury or inflammation of a membrane such as the peritoneum. The adhesion connects organs or surfaces.

ADMIXTURE—The substance formed by the mixing together of other ingredients.

ALBUMEN—A simple protein, such as the white of an egg. It is found in various foods, such as milk, meat, blood, etc.

ALIMENTARY CANAL—The digestive canal through which food is supplied to the individual.

ALLERGY—A reaction indicating sensitiveness of the individual to various factors such as food, dust, pollens, toxins, etc.

ANACIDITY—A condition of the stomach characterized by an absence of acid.

ANCYLOSTOMA DUODENALE—Hookworm, which produces so-called hookworm disease in man.

ANEMIA—A condition in which the blood is deficient in red blood cells, hemoglobin (blood color), or the total normal amount of blood.

ANODYNE—An agent which has the power to relieve pain.

ANOREXIA—Loss of appetite.

ANTI-RACHITIC—An agent which prevents or cures rickets.

ANTI-SCORBUTIC—An agent which aims at the prevention or cure of scurvy.

ANTI-SPASMODIC—An agent which prevents or reduces spasm.

ANUS—The lower opening of the digestive canal.

APPENDICEAL—Pertaining to the appendix.

ARTERIOLE—A minute artery.

- ARTERIOSCLEROSIS**—Thickening of the walls of the arteries as a result of disease, usually in older people causing loss of contractility and elasticity.
- ARTERY**—A blood vessel which conveys blood in the direction away from the heart.
- ASCENDING COLON**—The first part of the colon in the right side of the abdomen.
- ASCITES**—An accumulation of fluid in the abdomen (abdominal dropsy).
- ASSIMILATION**—The absorption of previously digested food and its incorporation in the tissues of the body.
- ASTRINGENT**—An agent which causes contraction of the tissues or arrests hemorrhage and secretions.
- ATONY**—Loss of tone, usually affecting muscle tissue.
- ATROPHY**—Wasting of the tissues.
- AUTODIGESTION**—The dissolving of tissue cells by the products of their own secretions—self-digestion.
- AUTO-INTOXICATION**—Poisoning from toxic substances produced in the body.
- AUTONOMIC NERVE SYSTEM**—That part of the nerve system which acts independently of the central nervous system (the brain and spinal cord).
- AUTOPSY**—Post-mortem examination of the internal organs of a dead body to determine the cause of death or for purposes of study.
- BACILLI**—A variety of bacteria, varying in size and shape, but usually rod-shaped or elongated in form.
- BACTERIA**—Unicellular (one-cell) vegetable micro-organisms (germs), usually producing disease.
- BARIUM**—A chemical element which in the form of barium sulphate is used in X-ray work to outline various organs of the digestive tract.
- BASAL METABOLISM**—The metabolism (wear and tear) of the body during a period of physical and digestive rest.
- BELCHING**—The process of raising gas from the stomach.
- BENIGN**—Mild in character, usually non-recurring, non-malignant.
- BILIOUS**—Characterized by a group of symptoms resulting from a disturbance in the bile tract.
- BLOATING**—Distention, usually of the stomach or bowels, caused chiefly by gas accumulation.
- BORBORYGMUS**—A rumbling or gurgling of the stomach or bowels.
- BOTHRIOCEPHALUS LATUS**—A variety of tapeworm.
- BOUGIE**—An instrument employed in the diagnosis and treatment of strictures of tubular passages such as the gullet.
- BRONCHI**—The respiratory tubes which lead from the trachea (Adam's apple) to the lungs.
- BUTYRIC ACID**—A product of fermentation, usually occurring in butter or other fat foods which have been ingested.
- CACHEXIA**—A condition characterized by the wasting of body tissues usually due to disease or starvation.

- CALCIUM**—A chemical element usually occurring in the body in the form of lime salt.
- CALLOUS**—Thickened and hard-skinned.
- CALORIE**—A unit of heat indicating the amount of heat required to raise the temperature of one gram of water one degree centigrade.
- CANCER**—A malignant growth.
- CANKER**—A small, benign ulceration frequently occurring within the mouth cavity, especially on the cheeks or tongue.
- CARBOHYDRATE**—A substance containing the elements carbon, hydrogen, and oxygen, the latter two in the proportion to form water. Examples: sugar and starch.
- CARCINOMA**—A malignant growth consisting of either epithelial or gland cells.
- CARDIA**—The point where the stomach and gullet meet.
- CARDIAC**—Pertaining to the cardia, as the cardiac end of the gullet or the cardiac end of the stomach.
- CAROTENE**—A yellow pigment present in various foodstuffs, as in sweet potatoes, egg yolk, carrots, etc.
- CATARRH**—A simple inflammation of a mucous membrane, such as the lining of the stomach or bowels.
- CECUM**—The beginning of the large intestine immediately below the point where the small intestine is attached.
- CHLOROPHYLL**—The green coloring matter of plants.
- CHLOROSIS**—A form of anemia characterized by a marked reduction in hemoglobin—out of proportion with the reduction in the number of red cells.
- CHRONIC**—Of long duration, usually applying to the progress and continuance of disease.
- CIRCULATION**—The course of the blood from the heart, through the arteries, capillaries, and veins, and back to the heart.
- CIRRHOSSIS**—A degeneration or atrophy of the cell structure of an organ, associated with an overgrowth of connecting tissue surrounding the cell structure.
- COALESCE**—To grow together, fuse, or become one.
- COLLATERAL CIRCULATION**—A newly formed circulation, made up of near-by blood-vessel branches, which acts as a substitute for the original disturbed vessel.
- COLON**—The large bowel, extending from the cecum to the rectum.
- COLOSTOMY**—The establishment of an artificial anus in the colon, usually attached to the abdominal wall and opening at the skin surface.
- COMBUSTION**—The burning or rapid oxidation of any substance, referring here to foods or body tissues.
- COMPLICATION**—The development of a morbid condition in the course of another disease.
- CONGENITAL**—Existing at birth.

- CONGESTION**—An increased amount of blood in the vessels of certain tissues, due either to an exaggerated flow of blood or to an obstruction to the outflow of blood from the vessels.
- CONJUNCTIVA**—The mucous membrane covering the front surface of the eyeball and lids.
- CONTRACTION**—A shortening or shrinking of tissues.
- CRYPTS**—Usually the pockets or tubular portions of a secreting gland.
- CYST**—An abnormal sac containing gas, fluid, or semi-solid material.
- CYSTIC BILE DUCT**—The duct which leads from the gall bladder to the common or main bile duct.
- CYSTICERCUS**—A type of bladder or sac-like worm.
- DEBILITATE**—To weaken.
- DECOMPENSATION**—A failure of compensation, usually referring to heart ailments.
- DECOMPOSITION**—Decay, disintegration, or rot.
- DEFECATION**—The discharge of excrement from the rectum.
- DEGLUTITION**—Swallowing.
- DEGENERATION**—Deterioration.
- DENUATION**—Depriving of a covering or protective layer.
- DESCENDING COLON**—The portion of the colon which descends from the hepatic flexure to the rectum.
- DETOXIFY**—To diminish or remove poisonous effects.
- DIABETES (*insipidus*)**—A disease of the pituitary gland, characterized by the passage of large quantities of urine.
- DIABETES (*mellitus*)**—A disease characterized by a disturbance in the metabolism of sugar.
- DIAGNOSIS**—The determination of the nature of a disease.
- DIAPHRAGM**—The partition separating the chest from the abdomen.
- DIARRHEA**—An abnormally frequent discharge of more or less fluid fecal matter from the bowel.
- DIASTASE**—A ferment which converts starch into sugar.
- DIFFUSE**—To spread about, to scatter.
- DIGESTIVE SYSTEM**—The group of organs which participate in the processes of digestion.
- DILATATION**—The enlargement or stretching of a cavity.
- DIMINUTION**—A lessening or reducing.
- DISTAL**—Toward the end, farthest from the center or from the point of origin.
- DISTENDED**—Stretched.
- DISTOMA HAEMATOBIIUM**—A type of worm or fluke.
- DIVERTICULUM**—A pouch or pocket which shoots off from a tubular organ.
- DUODENUM**—The uppermost small intestine.
- DYSFUNCTION**—The abnormal or incomplete function of an organ.
- DYSPNEA**—Shortness of breath.

- EDEMA**—An abnormal accumulation of fluid in the tissues; also known as dropsy.
- EJECT**—To throw off.
- ELABORATION**—Preparation for assimilation.
- ELICIT**—To bring about by examination.
- ELIMINATION**—The expulsion or removal of material from an organ.
- EMACIATION**—Extreme loss of flesh.
- EMBOLUS**—A plug, consisting of a blood clot, bacteria, or some other foreign body, which lodges in a blood vessel.
- ENCAPSULATED**—Enclosed in a capsule or sheath.
- ENCEPHALITIS**—Inflammation of the brain.
- ENDEMIC**—Relating to a disease peculiar to a district or group of persons.
- ENDOTHELIOOMA**—A tumor originating from the lining cells of a blood vessel.
- ENTERO-ANASTOMOSIS**—A new communication between loops of intestine, created by surgery.
- EOSINOPHILES**—White blood cells which stain readily with the dye eosin.
- EPIDEMIC**—Affecting many in a community.
- EPIGASTRIC HERNIA**—A rupture located in the epigastrium.
- EPIGASTRIUM**—The pit of the stomach or the upper central region of the abdomen.
- EPITHELIA**—Cells which usually line the tubular structures, such as the gullet, stomach, and bowels.
- EROSION**—The eating away or ulceration of tissue lining.
- ESOPHAGUS**—The gullet, a tube leading from the throat to the stomach.
- EVACUATION**—The process of emptying.
- EXACERBATE**—To increase the severity or symptoms of a disease.
- EXCREMENT**—Waste matter or any material cast out of the body, usually referring to the feces.
- EXFOLIATION**—The stripping off of layers or sheets of tissues.
- EXTIRPATE**—To remove.
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- FEBRILE**—Relating to fever or feverish.
- FECES**—Waste material from the bowels.
- FERMENTATION**—A chemical change induced in certain substances by the action of a ferment.
- FETUS**—The unborn child.
- FIBRIN**—An elastic protein, one of the end results of clotting.
- FIBROMA**—A tumor composed chiefly of fibrous connective tissue.
- FISSURE**—A slit or crack, usually located in the anus, where the skin and mucosa join.
- FISTULA**—An abnormal passage leading from either an abscess or a hollow organ to the skin surface, usually located near the rectum.
- FLUOROSCOPY**—X-ray illumination.
- FUNCTIONAL**—Pertaining to the physiological activity of an organ or other parts of the body.

GANGRENOUS—Pertaining to necrosis or death of tissue in which putrefaction has taken place.

GASTRALGIA—Stomach ache.

GASTRIC—Pertaining to the stomach.

GASTRIC ATONY—Loss of stomach tone.

GASTRIC SECRETION OR JUICE—The secretion of the stomach.

GASTRITIS—Inflammation of the stomach.

GASTRO-ENTEROSTOMY—An artificial connection between the stomach and intestine, created by surgery.

GASTROMYXORRHEA—The excessive secretion of mucus in the stomach.

GASTROPHOTOR—An apparatus which photographs the interior of the stomach.

GASTROPTOSIS—Downward displacement of the stomach (dropped stomach).

GASTROSUCCHORRHEA—Excessive secretion of the stomach juices.

GOURMANDISM—Eating to excess, gluttony.

GREAT OMENTUM—The large fold of peritoneum which passes from the stomach to the transverse colon.

GREATER CURVATURE—The large curvature (border) of the stomach.

GULLET—The tube leading from the Adam's apple to the stomach.

HABITUS—A characteristic body form.

HEMORRHAGE—Bleeding.

HEPATIC FLEXURE—The flexed portion of the colon just under the liver.

HEPATITIS—Inflammation of the liver.

HORMONE—A chemical substance formed in an organ or part of the body and carried through the blood to act in some other part of the body.

HYPERACIDITY—An abnormally high degree of acidity.

HYPEREMIA—The presence of an increased amount of blood in some part of the body.

HYPERSECRETION—Excessive secretion.

HYPERTONUS—Increased tone of the musculature.

HYPERTROPHY—Overgrowth of tissue.

HYPODERMIC—Underneath the skin, usually referring to a type of injection of medication.

HYPODERMOCLYSIS—Subcutaneous (under the skin) injection of a large quantity of solution, usually administered by the drop method.

HYPOPROTEINEMIA—A reduction in the normal amount of protein in the blood.

HYPOSECRETION—Reduced secretion.

HYPOTHESIS—A theory.

IDIOPATHIC—Pertaining to a condition or disease for which there is no apparent demonstrable cause.

ILEO-CECAL VALVE—The valve-like tissue located at the junction of the large and small intestine.

ILEUM—The lower portion of the small intestine.

INCEPTION—The beginning of a condition.

INGESTION—Introduction of food into the stomach.

INSALIVATE—To mix the food with saliva during the process of chewing.

INSOMNIA—Sleeplessness or wakefulness.

INTRACTABLE—Refractory or unmanageable.

INTRAVENOUS—Within the vein.

JAUNDICE—A yellowish staining of the skin, deeper tissues, and excretions with bile pigments.

JEJUNUM—The second portion of the small intestine.

KINKING—Twisting or running into knots.

LACTEALS—Lymphatic vessels in the small intestinal wall.

LACTIC ACID—A product resulting from the fermentation of milk or carbohydrates.

LAMBLLIA INTESTINALIS—A flagellate protozoan found in the small intestine, usually not disease-producing.

LARVA—The immature and wormlike form of an insect such as a maggot or caterpillar.

LARYNX—The upper part of the respiratory tract, between the pharynx and the trachea, in which the organ of voice production is located.

LASSITUDE—A sense of weariness.

LAVAGE—Washing, often referring to the stomach.

LESION—A diseased condition of the tissue, or its location.

LESSER CURVATURE—The small curvature or border of the stomach.

LINITIS PLASTICA—A chronic, contracting inflammation of the stomach.

LIPASE—A ferment which aids in the digestion of fat.

LIPOMA—A fatty tumor.

LUMEN—The passageway of a gland or other tubular organ.

LYMPH—A clear, yellowish or light straw-colored fluid which circulates in the lymph spaces or lymphatic vessels of the body.

MALIGNANT—Resisting treatment and tending to grow worse, as in cancer.

MAMMILLATED—Studded with nipple-like projections of tissue.

MASTICATION—The process of chewing.

MEDULLARY—Centrally located in a cylindrical structure, as the marrow in bone or the inner sheath in certain nerve fibers.

MENOPAUSE—Permanent cessation or stoppage of the menses.

MENSTRUATION OR MENSES—The periodical discharge of a bloody fluid from the uterus (womb).

MESENTERIC—Relating to the mesentery.

MESENTERY—A double layer of peritoneum, attached to the abdominal wall, which enfolds some of the abdominal organs and carries their blood vessels and nerves.

- METABOLISM**—Tissue change, which consists of the construction and destruction of tissue through chemical action.
- METASTASIS**—The shifting of disease or its local manifestation from one part of the body to another.
- MUCO-PURULENT**—Consisting of both mucus and pus.
- MUCOSA**—The mucous membrane which lines the passages and cavities of the body and secretes mucus.
- MUSCULATURE**—The muscles of the body.
- MYOMA**—A tumorlike enlargement composed of muscular tissue.
- MYXOMA**—A tumorlike enlargement composed chiefly of cells embedded in soft mucous tissue.
- NARCOTIZE**—To bring under the influence of a narcotic (an agent which produces sleep).
- NAUSEA**—Sickness at the stomach, with an inclination to vomit.
- NECROSIS**—Death of tissue.
- NEOPLASM**—A new growth or tumor.
- NEURASTHENIA GASTRICA**—A condition of nerve exhaustion marked by signs of indigestion.
- NEURO-MUSCULAR**—Pertaining to a combination of nerve and muscle tissue.
- NICHE PHENOMENON**—Indications of the filling of a pocket or pouch with barium and air, occurring usually either in the stomach or duodenum, the result of perforation.
- NODULE**—A small node or mass of differentiated tissue.
- NUTRITION**—The process of taking in and assimilating food products as a result of which tissue is built up and energy liberated.
- OBSTRUCTION**—The blocking of normal movement, as in cases of intestinal disease.
- OCCULT**—Hidden or concealed from view.
- OMENTUM**—A single or double fold of peritoneum passing from the stomach to another abdominal organ.
- ORGANIC**—Pertaining to the structure of the organs of the body.
- ORGANIZATION**—An arrangement of distinct but mutually dependent parts.
- OSMOSIS**—The passage of certain fluids through a membrane or other porous substance.
- OSMOTIC**—Pertaining to osmosis.
- OSTEOPOROSIS**—A disease of the bone marked by increased porosity.
- OVA, OVUM**—Eggs, egg.
- OXYURIS VERMICULARIS**—Pin worm, thread worm.
- PALATE**—Roof of the mouth.
- PALLOR**—Paleness or lack of color.
- PALPATION**—Examination by means of the hands, usually implying examination of the abdomen.
- PAPILLAE**—Small nipple-like processes.

- PARENCHYMATOUS**—Pertaining to the parenchyma (the distinguishing or specific tissue of a gland or organ).
- PENDULOUS**—Hanging free or loose.
- PENETRANS**—Penetrating or piercing the tissues of an organ.
- PERCUSSION**—Tapping the surface with the fingers or some other object, to determine the density of a part by the sound emitted.
- PERFORATE**—To pierce through the tissues of an organ.
- PERIGASTRITIS**—Inflammation around the stomach.
- PERIHEPATITIS**—Inflammation around the liver.
- PERISTALSIS**—A wormlike movement of the intestine or other tubular structure produced by alternate waves of contraction and relaxation.
- PERITONEUM**—The serous sac which lines the abdominal cavity and covers most of the organs within it.
- PERITYPHLITIS**—Inflammation of the first portion of the large intestine adjoining the ileum.
- PHLEBITIS**—Inflammation of a vein.
- PHYSIOLOGICAL**—Relating to the normal vital processes of living things.
- PLACENTA**—The organ of communication between the mother and fetus (unborn child).
- POLYP**—An outgrowth (footlike in shape) from a tissue, as in the lining of the stomach or rectum.
- PORTAL VEIN**—The large vein of the liver.
- PRECORDIUM**—The area of the chest overlying the heart.
- PRIMARY**—First.
- PROGLOTTIDS**—Segments of a tapeworm.
- PROGNOSIS**—A forecast of the outcome of a disease.
- PROLAPSE**—A falling down of an organ or part of the body, as of the rectum or uterus.
- PROPULSION**—Onward movement.
- PROTHROMBIN**—A nucleoprotein of the blood which, in conjunction with calcium salts, aids in blood clotting.
- PROXIMAL**—Nearest the point of origin.
- PSYCHIC ATTITUDE**—State of mind.
- PSYCHO-NEUROSIS**—A mental disorder, usually mild and not of an insane nature.
- PSYCHOTHERAPY**—Mental treatment.
- PTOMAIN**—A substance resulting from the decomposition of dead material, usually very toxic.
- PTYALIN**—A ferment of the saliva which digests starch.
- PULMONARY**—Relating to the lungs.
- PURGATIVE**—A cathartic.
- PURULENT**—Suppurating or pus-forming.
- PUTREFACTION**—The decomposition of proteins.
- PYLORIC ANTRUM**—The lower pole of the stomach, just above the pyloric canal.

PYLOROSPASM—Spasmodic contraction of the pylorus or stomach outlet.

PYLORUS—The canal or stomach outlet which leads to the duodenum.

RADIATION—The process of spreading or diverging from a point.

RECTUM—The terminal portion of the large intestine.

REFLEX—A reaction or involuntary response usually aroused through a nervous excitation.

REGURGITATE—To flow backward.

REPRODUCTION—The production of a new generation of living things, or procreation; the restoration of lost parts, or regeneration.

SACCHARO-BUTYRIC—Pertaining to the fermentation of both sugars and fats.

SALIVA—Spittle, or the secretion of the salivary glands which keeps the mouth moist and lubricates the food during chewing.

SALVARSAN—A drug known as "606," of arsenical background and usually employed to treat syphilis and other spirilla infections.

SANTONIN—A drug obtained from a plant and employed to expel worms from the bowel.

SARCINA—An organism of the coccacea group which divides in three planes producing cube-like cells, found in the stomach in cases of fermentation.

SARCOMA—Usually a highly malignant tumor of connective tissue substance.

SCIRRHOUS—Relating to a hardening of tissue due to a fibrous form of cancer.

SCLEROSIS—An induration or hardening of a chronic inflammatory origin especially affecting vascular structures (blood vessels) or nervous structures.

SECRETION—The product of cellular or glandular activity.

SECRETORY CURVE—Usually a graphic representation of a secretion in terms of its quantity, quality, or activity expressed over a certain period of time.

SEDATIVE—An agent which quiets the central or peripheral nervous system.

SENSORY DISORDERS—Ailments characterized by disturbances of sensation.

SEROUS—Pertaining to serum, as in inflammation associated with an out-pouring of serum or to serous membranes which line the closed cavities of the body such as the peritoneum.

SIGMOID FLEXURE—A part of the large intestine, shaped like the Greek letter sigma (s) and located just above the rectum.

SOFT PALATE—An aggregation of muscles in the roof of the mouth, one of which prevents food from passing into the nose.

SPASM—An involuntary muscle contraction or cramp.

SPHINCTER—A circular group of muscular tissues which act as a shutter to close or open the outlet of a hollow organ.

SPIROCHETE—A flagellated protozoan which has a wavy or threadlike form with an undulating membrane.

SPLENIC FLEXURE—That portion of the colon which turns downward and is usually located under or near the spleen.

STAGNATION—Cessation of motion in any vessel or hollow organ, usually due to congestion or back pressure.

STAPHYLOCOCCUS—One of a group of microscopic organisms which arrange themselves in clusters like grapes.

STASIS—Stagnation, usually referring to the intestinal contents.

STEAPSIN—A ferment which digests fats.

STENOSIS—A narrowing or stricture usually affecting a valve or outlet, as in the heart, stomach, or bowel.

STEROL—A solid alcohol, one of an important group of substances found in tissues.

STREPTOCOCCUS—A microscopic germ or bacterium usually arranged in curved lines resembling beads.

SUBCLINICAL—Pertaining to a condition which exists but does not produce outspoken symptoms.

SUBJECTIVE—Experienced by the subject or patient, but not evident to or capable of being produced by the examiner.

SUCCUSSION—A shaking of the body to ascertain if fluid is present in a cavity; a splashing sound will indicate the presence of air and liquid.

SUPERFICIAL—At, near, or pertaining to the surface.

SUPERINDUCING—Inducing or bringing on additional manifestations.

SYMMETRY—Equality or correspondence in the two opposite sides of the body.

SYMPATHETIC NERVE—One of the two subdivisions of the vegetative nervous system, the other being the vagus or parasympathetic nerve.

SYMPATHICOTONIC—Characterized by increased tone of the sympathetic nerve systems.

SYMPTOMATIC—According to symptoms, in speaking of treatment; also indicative of a specific disease.

SYMPTOMATOLOGY—Medical science treatment of symptoms of diseases.

SYMPTOMS—Signs or manifestations of disease.

SYNTHETIC—Relating to the building up of compounds by chemical or pharmaceutical means.

SYPHILIS—An infectious disease, usually acquired through sexual intercourse and due to inoculation by the spirochete pallida.

SYSTEMIC—Relating to the entire organism.

TAENIA—A tapeworm, of which there are many varieties.

TETANY—A disorder resembling tetanus and marked by intermittent muscular contractions.

THROMBI—Blood clots.

THYROID CARTILAGE—A prominence in the front of the neck known as the Adam's apple; in general the cartilage which surrounds that portion of the respiratory tract connecting the lower pharynx with the trachea.

THYROID GLAND—A ductless gland lying in front of the upper part of the trachea.

TOXIC—Poisonous.

TRACHEA—The windpipe extending from the larynx to the bronchi.

TRANSVERSE COLON—The part of the colon which crosses the abdomen from the hepatic flexure to the splenic flexure.

TRAUMA—Injury.

TREMATODES—Parasitic worms known as flatworms, including the flukes.

TRICHINELLA SPIRALIS—The parasite which produces trichinosis.

TRICHINOSIS—A disease caused by the presence of larvae of *Trichinella spiralis* in the muscles of the victims.

TRICHURIS TRICHIURA—The whipworm found in the large intestine.

TRYPSIN—A ferment in the pancreatic juice which digests protein.

TUBERCULOSIS—A disease produced by the tubercle bacillus.

ULCER—A sore or wound often affecting the lining of the stomach or duodenum.

ULTRAVIOLET IRRADIATION—Exposure to the actinic or chemical rays beyond the violet end of the spectrum.

UNCINARIA—A hookworm.

URETHRA—The canal which leads from the bladder outward to the body surface.

URTICARIA—Hives or wale-like eruptions of the skin, usually of systemic origin.

UTERUS—The womb.

VAGO-SYMPATHETICO-TONIC—Manifesting increased tone of both the vagus and sympathetic nerves.

VAGOTONIC—Characterized by irritability or increased tone of the vagus nerve.

VAGUS NERVE—A subdivision of the autonomic nervous system.

VEGETATIVE NERVOUS SYSTEM—The sympathetic or involuntary nervous system.

VERMIFUGE—An agent which causes the expulsion of worms from the digestive system.

VESSEL—A canal, tract, or duct which carries blood, lymph, or secretion.

VILLI—Projections of the small intestinal lining which contain lacteals and blood vessels concerned with absorption.

VISCERAL—Relating to the organs within the body trunk.

VOMITING—Ejection of the contents of the stomach to the outside through the mouth.

X RAYS—Roentgen rays generated by the impact of high-speed electrons on a metal target. They are electro-magnetic waves of high frequency, very penetrating and able to affect a photographic plate, and are of great value in the medical diagnosis of deep structures.

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